

AFIT/GCA/LAS/99S-1

IMPLEMENTATION OF AN ACTIVITY-BASED
COSTING SYSTEM IN AN AIR FORCE
LABORATORY ENVIRONMENT

THESIS

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THESIS

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Abstract

The purpose of this study was to examine the initial implementation of an Activity-Based Costing (ABC) system within the United States Air Force's Research Laboratories (AFRL). We were attempting to ascertain what the initial purposes for implementing ABC within AFRL were, then determine whether or not those goals were being attained. We also attempted to evaluate the current system's appropriateness for achieving those initial purposes. Finally, we provide suggested changes to the model and areas for future research.

We noted problems with AFRL's current ABC system. We were able to condense the problem into two main categories. First, when the system was initially designed, it was hampered by a rigid structure that was predetermined and there was also insufficient training for the personnel in charge of development. The second category is concerned with the implementation of their current system. There were many steps that could have been taken to ensure a successful ABC system. We believe ABC is a potentially beneficial tool that can be used by AFRL if it is developed and implemented in a different manner. ABC, as it is currently being used, is not a beneficial tool at lower levels within AFRL. In order to attain the full benefits of an ABC system, it must be beneficial to those lower levels where cost savings could be found.

IMPLEMENTATION OF AN ACTIVITY-BASED COSTING SYSTEM IN AN AIR FORCE LABORATORY ENVIRONMENT

I. INTRODUCTION

Background

Mr. Christopher Jehn, the Assistant Director from the Congressional Budget Office supplied the following information at the 32nd Annual DoD Cost Analysis Symposium. Even with the current increases President Clinton is requesting for the DoD budget, future funding is substantially inadequate to sustain needed modernization of the United States Armed Forces. For instance, under current DoD military construction budget projections, it would take approximately 200 years to replace the military's buildings. Mr. Jehn estimated that the DoD budget would have to average 350 billion dollars over the next 15 years in order to maintain force structure, meet modernization goals and sustain average aircraft age (Jehn). Separately, Mr. Tom Weideman from Air Force Research Labs (AFRL) confirmed that AFRL is also expecting to experience reduced funding over the next several years (Weideman).

Our research team received inquiries by AFRL and AFRL's Directed Energy Directorate (AFRL/DE) about analyzing their current cost accounting system.

AFRL/DE is one of nine research directorates specializing in a specific technology area. The Directorate is located at the Phillips Research Site, Kirtland Air Force Base, New Mexico. AFRL/DE, headed by Dr. R. Earl Good, has a workforce of more than 1200 people, an annual budget of

approximately \$210 million, and 6,000 square feet of working space (AFRL/DE). Their mission statement is as follows:

Develop, integrate, and transition science and technology for Directed Energy to include high power microwaves, lasers, adaptive optics, imaging and effects to assure the preeminence of U.S. in air and space.

The Directorate is organized into six technical divisions:

- The Advanced Optics & Imaging Division
- The High-Power Microwave Division
- The Laser Division
- The Optical Surveillance Division
- The Starfire Optical Range Division
- The Technology Assessment & Planning Division. (AFRL/DE, 1999)

In 1997 Major General Richard R. Paul issued a memorandum stating that in today's environment, managing AFRL's cost of doing business is of utmost importance (Pitel, 1997). In response, AFRL started implementing a different method to account for their costs. The method they are implementing is referred to as Activity-Based Costing (ABC). Ideally, ABC will provide additional cost visibility throughout AFRL by using a common ABC taxonomy (AFRL Corporate Board, 1998). Additional cost visibility refers to the leadership's ability to accurately understand the true costs associated with cost objects within the various laboratories. In order for the ultimate goal of additional cost visibility to be realized, AFRL must finish implementation of a sound ABC system that will provide the necessary information to enable AFRL leadership to make informed, cost-reduction decisions.

Activity-Based Costing is an accounting technique utilizing an information system that maintains and processes data on a firm's activities and products. It identifies the activities performed, traces cost to these activities, and then uses

various cost drivers to trace the cost of activities to cost objects, thus providing a system which is able to cost products and services by the activities used to produce them (Secretary Of the Air Force Staff, 1998). Therefore, in ABC systems, the focus of the cost accounting system becomes activities instead of products.

The practical applications of ABC have become widespread only recently. In fact, the oldest documented ABC system is less than 20 years old (Cooper, 1990:33). ABC was initially developed for manufacturing settings but has grown over the past several years to include the service industry (Secretary Of the Air Force Staff, 1998). The functionality of an ABC system is similar in both settings.

Traditional accounting systems use a simple and relatively straightforward approach for allocating overhead or product support costs that are charged indirectly to a product or service. The typical cost accounting system assigns costs to products using direct labor as an allocation base (Woods, 1989:42). Allocation is the process of assigning cost to an activity when a direct measure does not exist or is not economically feasible from a cost/benefit standpoint (Miller, 1996:67). A direct measure may not be available because it is costly to install measuring equipment. For example, machine tools use power, but it may be too expensive to put a meter on every machine. So instead of a direct measure, power consumption can be estimated by the amount of time the machine is operated. Thus, machine hours become the allocation base for power consumption. Machine hours can also be used to allocate labor costs that can be directly attributed to a product because number of hours of machine time approximates the number of hours worked on an

item. The previous example illustrates the fact that the use of a single allocation base is grounded on the assumption that the product's cost varies directly in relationship to that single base (LaLonde and Pohlen, 1993:13). If a company produces either one product or a homogeneous product line, then a traditional cost accounting system should provide them with very accurate cost for their product. This is primarily due to the fact that the allocation of overhead rates is not distorted since either the single product or the homogeneous product line should consume overhead resources in a similar manner. However, traditional cost systems have many failings, in particular their inability to report product costs to a reasonable degree of accuracy for multiple products that are not homogeneous in nature (Cooper, 1990:33). This lack of accuracy stems from conventional accounting systems using, at most, three allocation bases, whereas ABC systems make use of many bases (Cooper, 1988a:45). Traditional allocation bases will often be labor hours, machine hours or direct material costs. In contrast, ABC systems will use multiple, activity-related allocation bases like number of line set-ups, number of orders, and number of times items are handled.

As we just explained, an organization having a very diversified or non-homogeneous product base is a good candidate to use an ABC system. AFRL is composed of ten Technical Directorates (TDs), which provide myriad services; this raises doubts about the homogeneity of their products. Therefore, the use of an ABC model appears to be warranted to track indirect costs within AFRL's laboratory environment.

ABC is valuable because it allows the user to more accurately attach overhead or indirect cost to products or services. Unless overhead costs are accurately assigned to cost objects, the services a company provides may be over or undervalued. For this reason General Babbitt, Air Force Materiel Command Commander (AFMC/CC), requested AFRL develop a plan for implementation of an ABC system. AFRL's intention is to use their newly implemented ABC system to drive down costs while maintaining the quality of their products by gaining cost visibility needed to reduce infrastructure costs (AFRL Corporate Board, 1998). Specifically, they intend to reduce science and technology (S&T) product support costs to 19% of total cost from their current level of 24% (a 5% reduction) by FY05 (AFRL Corporate Board, 1998). Mr. Tom Weideman iterated that AFRL and the laboratories would use the ABC system to obtain previously unevaluated cost information and use it to make cost reduction decisions; however, the TDs will make the individual choices as to which costs to cut without impacting the quality of their products. There is currently no intention to cut any specific products, but rather to find areas that have high support costs to product costs ratios and look at those more carefully (Weideman).

ABC is important because it provides substantially more insight into an organization's financial system than a traditional accounting system. ABC is used more as a diagnostic technique to generate the information needed to make strategic decisions (LaLonde et al, 1994:24). Given this diagnostic tool for improving the

quality of cost visibility, AFRL laboratories should be able to obtain better data allowing them to make better-informed, cost-reduction decisions.

AFRL accounts for their available funding using unique terms. In particular, AFRL uses the term revenue. The term revenue, when used within AFRL circles, is not indicative of the typical revenue accounting term. Instead, it simply refers to all the funding AFRL receives in order to conduct its research. The types of funding AFRL receives are Congressional plus-up funding, reimbursable funding, and Biannual Planning Programming Budgeting System (BPPBS) funding.

In order to accomplish the tasking set forth by General Babbitt and General Paul, AFRL implemented ABC in the following manner. First they divided their budget (in the AFRL lexicon, budget is referred to as projected revenue) into two groups, product and product support. (Runkel, 1998). The product group constitutes all extramural research (research that is contracted out and done outside of Air Force facilities) and in-house research, and at the start of FY97 this category consumed 76% of total revenue. Which costs are included in the product group is determined by direct job order numbers (JONs). Product support is subdivided into three top-level business activities: Program Formulation, Project Management and Technical Application. These three activities are the first level of activities within product support. The activities involved in these areas will be further defined in Chapter Two.

AFRL/DE has implemented an ABC system that was also put in place throughout AFRL. AFRL/DE is interested in obtaining an outside appraisal of their

ABC system which would provide a new perspective and suggestions for possible changes which could improve their model's ability to provide important information necessary to make informed cost reduction decisions. For instance, AFRL/DE has posed the questions: what is their real product, and are they contributing overhead to it in a proper manner? In ABC terminology, the question becomes: what are their cost objects, and which activities and associated cost drivers will allow them to allocate overhead costs to their products in a more accurate manner?

Problem Statement

On both the 22nd of June and the 15th of July 1998, AFRL held its Corporate Strategy Development Process to develop their Corporate Strategy to the year 2010. These critical issues were discussed during that meeting: defining and implementing standard definitions for product and product support costs, standardized data collection and estimation procedures, and integration of the ABC data collection process with the AFRL strategic planning process (AFRL Corporate Board, 1998). Along with the first two issues, conversations with Mr. Tom Weideman and Col Richard Schuetz led to the problem statement development.

Currently, the Air Force's Research labs have two broad concerns regarding ABC implementation. First, there is a concern as to the appropriateness of the ABC model that AFRL is implementing. Both headquarters and the field technical directorates want to use the ABC data to better understand their core of operations

and to make more informed cost-reduction decisions (Runkel, 1998). However, AFRL's current ABC system is still being implemented, and questions remain about the current ABC structure providing useful information. This could be attributed to a variety of reasons, including the overall structure of AFRL's model, the individual ABC model's components, the way the data is collected in the field and reported in the ABC system, or the appropriateness of an ABC model in a research environment. The second concern is a need for standardization. Field activities generally do not follow the same business practices, which may impact the way data is collected and reported for ABC. Also, lessons learned about cost reductions by one Technical Directorate (TD) may not be applicable to another.

Research Objectives

In order to answer the question of whether or not AFRL's ABC model is appropriate we need to examine certain aspects of the implementation. We have divided our examination into five research objectives:

- Determine the overall motivation for implementing ABC for AFRL headquarters and at the Technical Directorate level
- Determine how the information is actually being used at the TD and HQ levels compared to stated motivations or objectives
- Appraise AFRL's overall ABC model appropriateness and potential for providing AFRL's needed information by comparing their existing model to standard ABC practices. Evaluate current model's structure, resources,

activities, cost objects, cost drivers, cost pools and allocation bases in light of accepted ABC models and AFRL needs

- Understand and evaluate AFRL/DE's unique inputs that are being injected into the current AFRL model with regard to the potential for standardization
- If deficiencies are found, provide suggested improvements and guidelines on how to formulate adaptations for individual TDs
- Provide a foundation and direction for future research

Research Scope

We intend to study the ABC model being used throughout AFRL. After developing an understanding of AFRL's model and what benefits the model may provide, we will use the information gained from our literature review and information gained through our study of AFRL to critique the current model. Through this critique we will be able to suggest improvements to be incorporated into a future model. We will analyze the current ABC model using information provided by AFRL/DE. Along with AFRL/DE we will also ask AFRL at Wright-Patterson Air Force Base (WPAFB), Ohio to provide us informational support upon request. Within AFRL/DE we will interview those who understand the current ABC structure. We will also interview personnel who understand those activities performed in the laboratory and/or have knowledge about the desired information needed for cost reduction decisions. We will also interview subjects from other Technical Directorates as a cross-check on the data we receive from ARL/DE. As a

byproduct, we intend for our research to provide a strong foundation for additional research teams to accumulate data for a more specific model within a single laboratory environment.

Research Methodology

By analyzing current and proposed ways for implementing ABC and the activities performed within AFRL, we intend to address our research questions concerning the appropriateness of AFRL's ABC model and, if applicable, develop a set of improvements that can be used by AFRL. The current model will be critiqued as to how well it provides the information needed to make informed, cost-reduction budgetary decisions. Informed decisions refer to the individual TD's ability to cut cost by eliminating waste without adversely affecting their mission. Therefore, the ultimate purpose of AFRL's implementation is to reduce support costs enabling, increased investment in S&T products.

The analysis of AFRL/DE's model will require a thorough collection of current data pertaining to AFRL's ABC system. We will collect this data in two ways. First, we will analyze the current ways in which AFRL is implementing their ABC system. Preliminary methods for data collection will use current documents, briefings, and publications issued from AFRL and AFRL/DE. Our efforts should equip us with the information and insight to visit AFRL/DE and explore various questions formulated during our preliminary research. Our second form of data

collection will be interviews with the personnel responsible for the implementation and maintenance of the ABC system.

Our interview questions will be aimed at obtaining two different categories of information. First, we will attempt to appraise opinion concerning the laboratory ABC cost environment and views as to the appropriateness of the information being provided by their current ABC system. For example, what information is being derived by the current model and does it provide the information necessary to make better informed cost reduction decisions? Second, we will ask further questions concerning activities performed, feasibility of using cost tracing versus allocation, possible drivers for those activities, and similar probing questions concerning costs and activities. A more detailed description of our proposed interview process will be explained in Chapter III.

In Chapter IV we will organize and restate the data that has been collected. First, we will illustrate how AFRL intends to use ABC information by enumerating the overall goals of the program and then describing how the information will specifically help attain those goals. Second, we will lay out the current ABC structure and show how costs are being grouped as well as what are being used as cost drivers and cost objects. Next, we will list the areas where the activities of AFRL/DE differ from the other directorates, describe the differences, and then describe what adaptations have been made to the overall AFRL model to accommodate them. In Chapter V we will do the analysis of the data collected, to include any suggested improvements to the model, should they apply.

Research Limitations/Generalizability

General Paul indicated the primary business activities for S&T will be program management, project formulation and technology application. Our research will be specifically tailored for AFRL, and much of the information we will collect will come from AFRL/HQ, AFRL/DE, and other TDs at Kirtland AFB and WPAFB. Due to the exploratory, top-level nature of this study, we expect our conclusions will apply to all of the TDs within AFRL. However, we have reservations about how generalizable our research will be to organizations outside AFRL.

Research Contributions

Our intent is to provide AFRL and AFRL/DE an outside opinion critiquing their ABC system. We intend to compile information relating to general ABC issues and AFRL's specific ABC implementation efforts. Based upon current ABC literature, we will provide an independent assessment of how the model may be improved, if necessary. Furthermore, if in the course of our research we discover systematic problems with the implementation in individual directorates that can be approached in a general way, we will provide guidelines for adapting the overall model to each directorate's situation. Whether or not our conclusions agree with current ABC practices within AFRL, we hope to provide fresh ideas and insights concerning AFRL's implementation of their ABC systems. We hope these insights will enable AFRL to better define their ABC processes and receive more valuable

information from their ABC system. In addition, the framework set forth in this thesis will enable further research studies to develop in greater detail an ABC system for AFRL and in other DoD service organizations.

Summary

This thesis will help alleviate some of the problems that are currently being experienced in the Air Force Research community concerning ABC. This chapter started by providing some background on ABC and its relevance within AFRL. It addressed AFRL's implementation of ABC and areas of concern that they are encountering. Chapter II contains a literature review of pertinent information that has been published about ABC. We will be focusing on articles that provide insight for eliminating the difficulties mentioned in the problem statement section of Chapter I. Chapter III provides the methodology we will be using to address the problems discussed and information gained in the previous two chapters. Chapter IV contains our collected data and analysis as set forth by our methodology. Finally, Chapter V provides our conclusions and interpretations of our findings. We will also suggest research areas that may be investigated by other research teams.

II. LITERATURE REVIEW

Introduction

In this chapter we will methodically review the literature on the subject of Activity-Based Costing. Throughout this literature review, we will accumulate pertinent information related to our problem statement and research objectives.

The next portion of this chapter will provide a brief overview of the conventional accounting method of attaching costs to products and services. It will also point out some of the problems with conventional accounting systems and how ABC alleviates those problems. The following section will provide a more detailed picture of ABC, introducing specific terms and how they relate to each other. Next, we will discuss ABC model formulation. Finally, our literature review will end with a more detailed look at AFRL structure and the activities at AFRL/DE.

Conventional Cost Accounting Systems

Traditional accounting systems use a simple and relatively straightforward approach for allocating overhead costs, such as general and administrative (G&A), that are charged indirectly to a product or service. Many accounting systems assign costs to products by using direct labor as an allocation base (Woods, 1989:42). Use of a single allocation base rests on the assumption that the product's cost varies directly in relationship to that single base (LaLonde, et al, 1993:25). As part of an

example (modified from Horngren, et al, 1997:107-111), Figure 1 illustrates a simple cost allocation system for a grocery store.

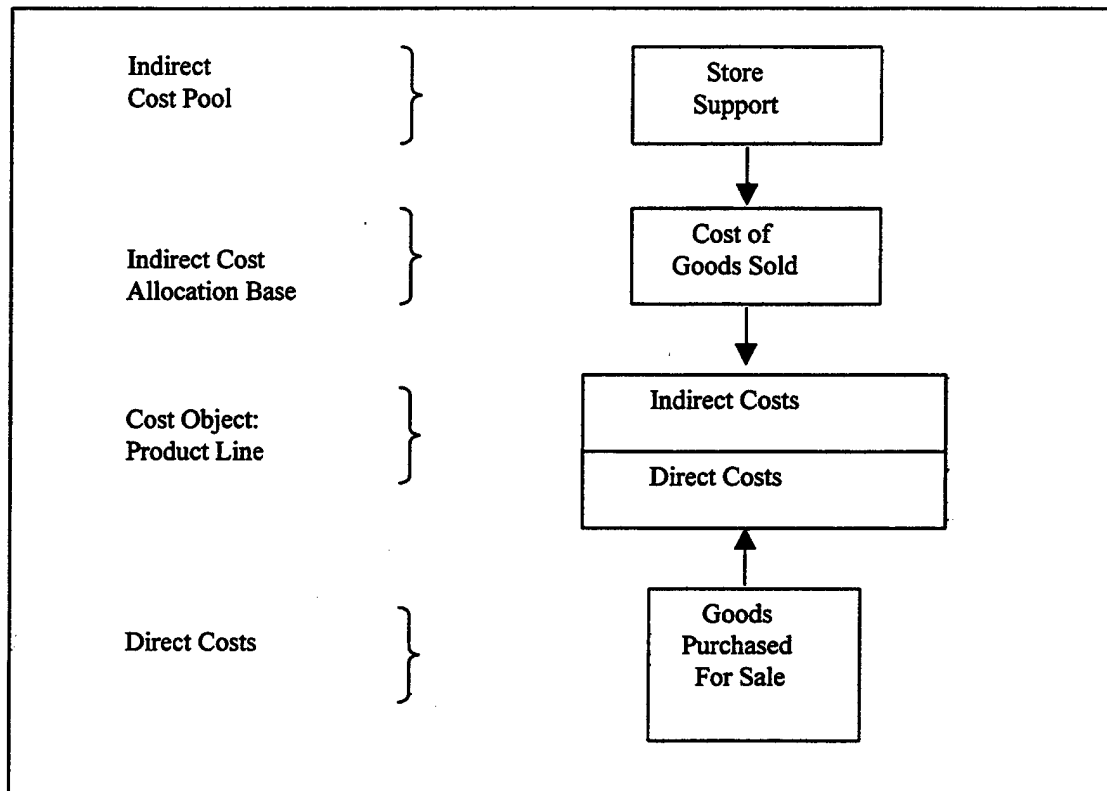


Figure 1: Single Indirect Cost Pool, Single Direct Cost Category (modified from Horngren, et al, 1997:104)

In this example, the management of a grocery store has been using a traditional, one allocation base system to track the profitability of three product lines: soft drinks, fresh produce, and packaged foods. Store support costs were allocated to products at the rate of 30% of the cost of goods sold. Table 1 presents a product line profitability statement.

Table 1: Monthly Profitability Report (in 1000s) (Horngren, et al, 1997: 108)

	<u>Soft Drinks</u>	<u>Fresh Produce</u>	<u>Packaged Food</u>	<u>Total</u>
Revenues	<u>\$26,450</u>	<u>\$70,020</u>	<u>\$40,330</u>	<u>\$136,800</u>
Costs				
Cost of Goods sold	\$20,000	\$50,000	\$30,000	\$100,000
Store Support	6,000	15,000	9,000	30,000
Total Costs	<u>26,000</u>	<u>65,000</u>	<u>39,000</u>	<u>130,000</u>
Operating Income	<u>\$ 450</u>	<u>\$ 5,020</u>	<u>\$ 1,330</u>	<u>\$ 6,800</u>

Historically, the use of a single allocation base had validity. Even in the early twentieth century, direct costs, such as materials consumed or workers' wages associated with the production and sale of goods and services, comprised a major share of total costs. The ratio of indirect costs, such as bookkeeping, to direct costs was relatively low (Harr, 1991:24). Therefore, one cost driver for overhead did not distort product and service costs to any significant degree. However, the proportion of indirect costs has risen and now comprises a major share of total product costs (Harr, 1991:24). Among other factors, this shift in product cost makeup degrades the ability of conventional accounting systems to provide the relevant information necessary for decision making and cost management.

Distortions in product cost arise for a number of other reasons, including diversity in production volume, size diversity, complexity diversity, material diversity and setup diversity (Cooper, 1988b:41). Traditional accounting systems often assume that different products consume resources at uniform rates. In fact,

different products, customers, and distribution channels often make tremendously different demands on a company's resources (Cooper and Kaplan, 1991:131).

If management of an organization with a single allocation base wants more accurate cost data, they will have to refine the system. One of the ways products can be costed more accurately is by tracing more cost categories directly (Horngren, et al, 1997:103). Figure 2 illustrates this.

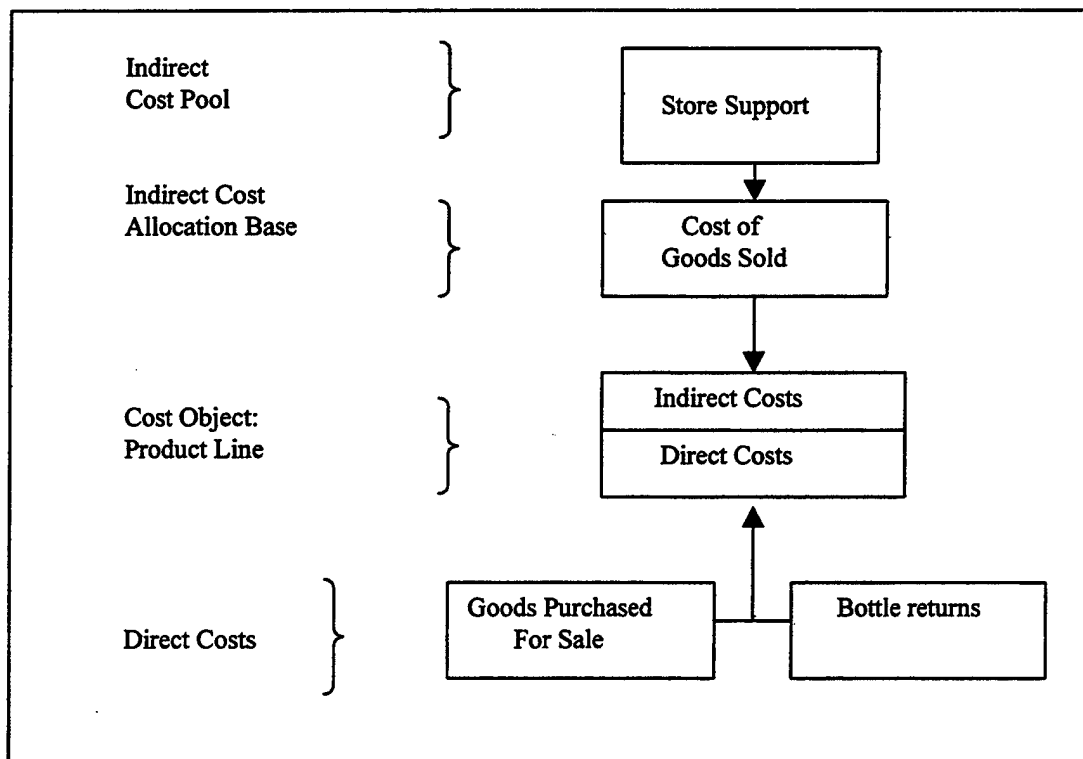


Figure 2: Single Indirect Cost Pool, Multiple Direct Cost Categories (modified from Horngren et al, 1997:104)

While in this example, adding bottle returns as a direct cost to the soft drinks product line will not make a large difference, the cost does come out of store

support costs and is therefore not misallocated to other product lines. The more costs that are found that can be realistically and economically traced, the more accurate the product costs will be (Horngren, et al, 1997:103).

Further refinements to conventional systems can be made, such as adding multiple indirect cost pools, as in Figure 3. Each additional indirect cost pool that is a collection of homogeneous costs that can be allocated with its own, unique allocation base should add accuracy to the system (Horngren, et al, 1997:106).

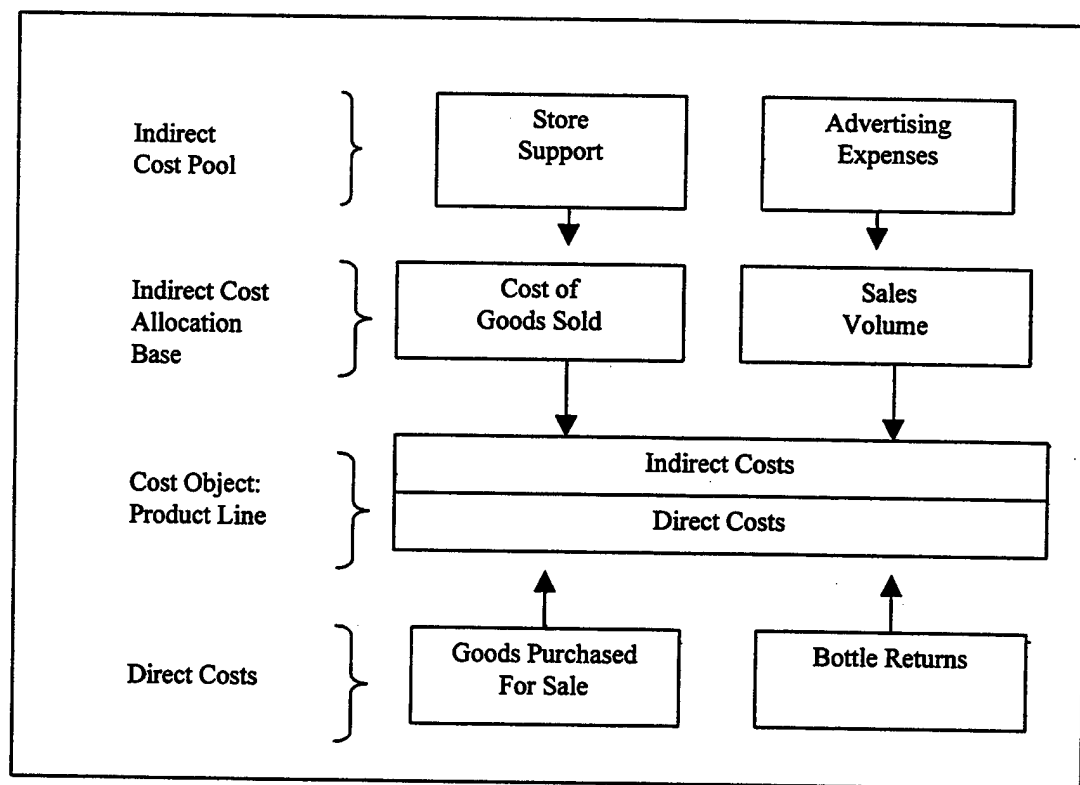


Fig 3: Multiple Indirect Cost Pools, Multiple Direct Cost Categories (modified from Horngren, et al, 1997:104)

We have now added another indirect cost pool. Since it uses a different allocation base, it should return a better picture of advertising expenses for products, provided there is a causal link between the allocation base and the cost pool (Horngren, et al, 1997:105).

In many conventional accounting systems the relationship connecting costs allocated to a product and cost actually caused by its production is tenuous. When there is no logical relationship between the allocation base and the product costs then the allocation is arbitrary (Woods, 1989:43). In the further development of the grocery store example we will see how a system more in tune with cause and effect can improve accuracy. The inaccuracy of an arbitrary allocation causes many products to be either over or under valued by their producer. Because of inaccurate cost data, the producer is unable to competitively market their product. They will over-cost a cheap item and then be underbid by competition, or they will under-price a more expensive item and miss out on profits or lose money, even though their books are showing a profit for that item (Cooper, 1988b:43-44, Horngren, et al, 1997:110).

ABC Systems

The concept behind ABC is quite simple. Namely that product costs consist of the cost of raw materials used plus the aggregate cost of all activities that were performed in order to produce the product (Beaujon and Singhal, 1990:51). By breaking down the activities in the production process, we can account for non-

uniform resource usage. ABC tries to allocate overhead costs to cost objects in a manner consistent with cause and effect (Siau and Van Lindt, 1997:38).

ABC can provide better visibility into indirect costs compared to conventional accounting systems. Conventional cost systems focus on the product in the costing process, while ABC emphasizes the activities involved in producing the product (Cooper, 1988a:45). In a conventional system, large pools of indirect costs are assessed to products through the use of one to three cost drivers, typically volume-based drivers, that may or may not reflect the actual cost of that product. For example, a conventional cost system may assume that overhead is uniformly incurred for services in proportion to the direct labor (traditional allocation base) used to provide each unit of service (Harr, 1991:25). This can lead to systematic distortion of product costs (Cooper and Kaplan, 1988a:21). Implementation of ABC in some settings supports this view: product costs reported by ABC systems often differ significantly from the corresponding costs reported by traditional product costing systems (Cooper and Kaplan, 1988b:100).

Instead of being a further refinement of allocation bases, an analysis done to implement an ABC system will look at the activities that incur costs. These activities are performed in support of some objective, which is therefore responsible for the cost of those activities (Turney, 1990:40). We will describe the process of designing an ABC system in more detail later in this chapter. In Figure 4 we see what a possible ABC system might look like in the grocery store example.

Using the activities and cost drivers we can now allocate costs even more accurately. Table 2 and Table 3 provide supporting cost data for the model depicted in Figure 4.

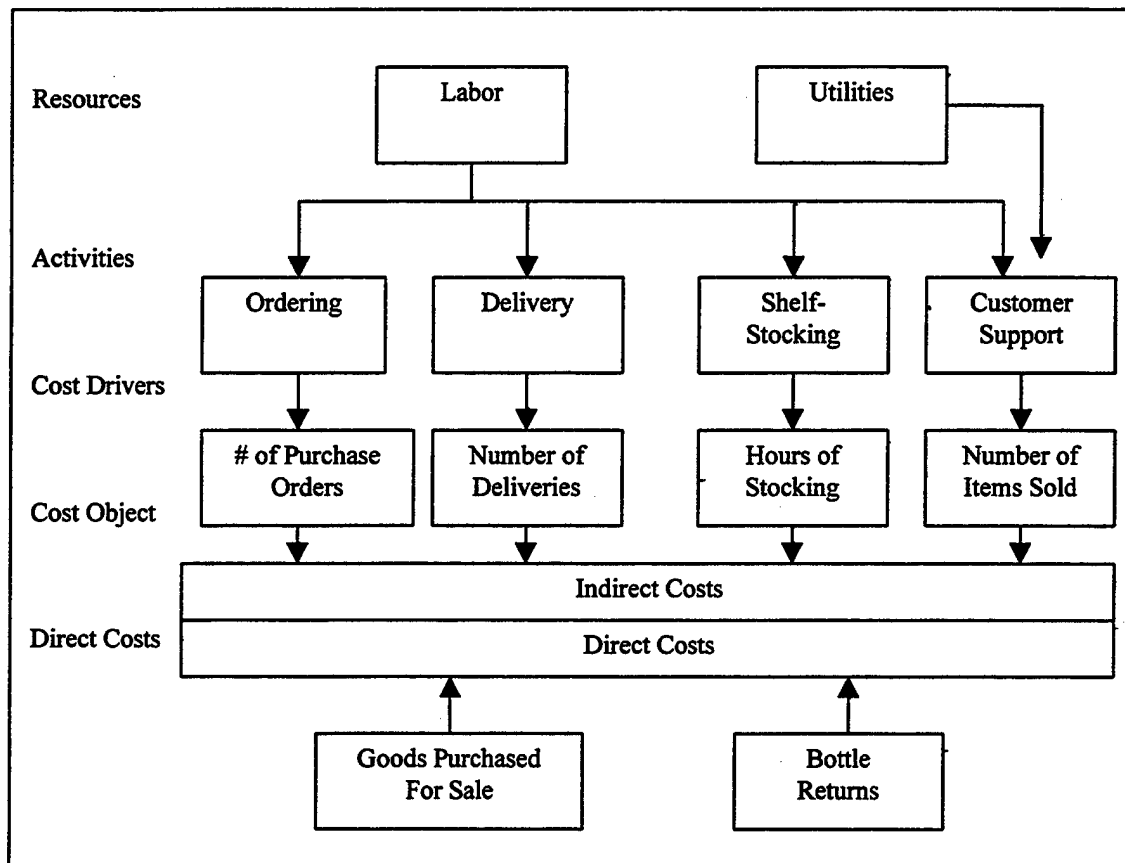


Figure 4: ABC Diagram (Horngren, et al, 1997:111)

Table 2: Example Activities and Cost Allocation Bases (Horngren, et al, 1997:110)

Activity Area	Cost Allocation Base	Amount of Driver Used		
		Soft Drinks	Fresh Produce	Packaged Food
Ordering	\$100 / purchase order	12	28	12
Delivery	\$80 / delivery	10	73	22
Shelf-stocking	\$20 / hour	18	180	90
Customer Support	\$0.20 / item sold	4,200	36,800	10,200

The associated profitability statement reveals some differences in the costs arrived at by the simple allocation system in Figure 1 versus the ABC allocation in Figure 4. Table 3 is a revised profitability statement for the same period, this time using ABC.

Table 3: Monthly Profitability Report (in 1000s) (Horngren, et al, 1997:111)

	Soft Drinks	Fresh Produce	Packaged Food	Total
Revenues	<u>\$26,450</u>	<u>\$70,020</u>	<u>\$40,330</u>	<u>\$136,800</u>
Costs				
Cost of Goods sold	\$20,000	\$50,000	\$30,000	\$100,000
Bottle Returns	400	0	0	400
Ordering	1,200	2,800	1,200	5,200
Delivery	800	5,840	1,760	8,400
Shelf-stocking	360	3,600	1,800	5,760
Customer Support	840	7,360	2,040	10,240
Total Costs	<u>23,600</u>	<u>69,600</u>	<u>36,800</u>	<u>130,000</u>
Operating Income	<u>\$ 2,850</u>	<u>\$ 420</u>	<u>\$ 3,530</u>	<u>\$ 6,800</u>

Note that the apparent profitability of the different product lines has changed dramatically – the operating income from soft drinks has gone up nearly seven-fold, while the income from fresh produce has dropped more than 90%. This type of information could prevent management from expanding the produce section at the expense of shelf-space for soft drinks. Under the old system that would have seemed to be the logical way to improve profitability, a move that could have been disastrous for the grocery.

Uses of ABC Systems

By itself, activity-based costing is only a tool for obtaining more accurate cost information. However, the uses and applications of ABC are still evolving. Currently, a more developed philosophy is en vogue: Activity-Based Cost Management (ABCM), more commonly called Activity-Based Management (ABM). These two concepts trace the development of ABC from a manufacturing product costing application to a broader concept of activity management in areas other than manufacturing (Miller, 1996:ix). Miller identifies a veritable laundry list of Activity-Based Management uses, singling out three applications as the primary ones:

The most common area of use is to determine product/service cost where accuracy is required for operational and strategic decisions of product mix, product pricing, product line investments, and production alternatives. A second common use is to support efforts directed toward improving performance. A third common use is for organizations to use the information to reduce costs. (Miller, 1996:16)

Organizations often discover that product and service costs are distorted when customized, low-volume products/services are costed in the same system as high-volume, standardized products/services. This can result in a cross-subsidy, where the high-volume product/service is overcosted and the low-volume product/service is under-costed. Organizations are also surprised to find that a small percentage of specific product or service revenues can account for a large percentage of profit.

The full potential of ABC is not brought to bear until product or service costs are calculated by distribution channel, customer segment and/or geographical area.

Management may learn that many of these marketing subsets are unprofitable when all activities associated with development, distribution, production, marketing and sales are considered (Miller, 1996:17).

ABM can be used to scrutinize the key activities and processes critical to the success of the organization. Activities with a high potential for improvement can be identified and restructured or modified to improve performance. Improvement efforts can be focused on areas providing the biggest bang for the buck. After such an initiative, ABM can be used to monitor results. The ABM system can then continue to provide feedback necessary to sustain the improvement effort (Miller, 1996:18).

Cost cutting and downsizing can be guided by ABM. The current corporate climate rewards lean, profitable organizations and punishes bloated ones. Many corporations attempt to cut costs by the simple expedient of cutting across the board in all areas of the organization. The layoffs, plant closings, and idled equipment are

rarely effective. According to Peter F. Drucker, management consultant and noted author, cutting costs effectively is best done by cutting activities – “there is little point in trying to do cheaply what should not be done at all” (Miller, 1996:18).

Value of Implementing ABC

How can an ABC system be judged to be useful or not? One of the benefits of ABC is that it assists management in developing an understanding of what causes costs to be incurred (Ellis-Newman and Robinson, 1998:381). The usefulness of an ABC model also depends on the level of detail at which activities are defined, how much work it takes to associate costs with activities, and whether or not a typical user of the information generated is likely to interpret it correctly (Beaujon and Singhal, 1990:52). Companies have developed ABC systems so that they can directly link the costs of performing organizational activities to the products and customers for whom the activities are performed (Cooper and Kaplan, 1992:1). The value can also be measured by how much an ABC model can help managers reduce resource usage by either reducing the number of times activities are performed or by increasing the efficiency with which activities are performed (Cooper and Kaplan, 1992:10).

Applicable Costs

Cooper, Kaplan, and others argue that there are three types of costs that should not be passed on to products in an ABC system. First, the costs of excess capacity

should not be charged to individual products, but rather to excess capacity as a cost object itself. Excess capacity can also be thought of as unused capacity. This does not mean that unused capacity is wasted, the capability to increase output may be necessary to maintain. However, unused capacity may be a starting point for cost reductions (Cooper and Kaplan,1988:101).

Second, Cooper and Kaplan also argue that research and development for entirely new products should not be pushed down to individual products using ABC. They recommend splitting R&D costs into two categories: improvements and modifications to existing products and those that relate to completely new products. The first category is a direct cost of improving those products and should be traced.

The second category is a different animal. Financial accounting treats R&D as a cost of the period in which it takes place. The management accounting system, in contrast, should treat these costs as investments in the future. Companies engaged in extensive R&D for products with short life cycles should measure costs and revenues over the life cycle of their products. Any periodic assessment of product profitability will be misleading, since it depends on the arbitrary amortization of investment expenditures including R&D. (Cooper and Kaplan,1988b:102)

The third type of activity whose costs should not be allocated using ABC is facility-level, one of four levels of activity as originally identified by Cooper. He illustrates a hierarchy of activity costs in a manufacturing plant: unit-level, batch-level, product-level, and facility-level (Cooper and Kaplan, 1991:131). Unit-level activities are those required for the production of a single unit of output. An example may be the insertion of processor chips onto a circuit board – that activity

is required for each circuit board. Batch-level activities occur whenever preparations are made for a production run. If an assembly line needs to be configured for a run of parts, then the cost of the set-up activity relates to that particular batch, no matter how many units are produced. Similarly, product-level activities are performed to support the manufacturing and distribution of individual product lines. Advertising for a truck model supports the entire line, not any particular batch or unit. Facility-level costs support the upkeep of facilities that may be used for multiple products, to include any managerial infrastructure that makes production possible. Another way to describe facility-level costs is to call them the costs of opening the door for business, whether anything gets done or not. ABC systems can identify and cost activities at the facility-level for which it's not realistic to identify a cost driver and thus tie it to a product. Some activities sustain the manufacturing process, the plant, or the organization but are not required by a specific product. An office manager does not support the work of any individual in a professional partnership, but the partnership would not function without her. Process-level (facility-level) activities still consume resources and can offer opportunities for reducing cost (Turney, 1991:30).

Considerations in Implementing ABC

Before embarking on an implementation strategy, one should assess the barriers to implementation of an ABC system. One of the factors that lead to the failure of an ABC system is organizational resistance (Roberts and Sylvester,

1996:24). Employees get set in their ways or even fear for their jobs. Managers are generally not happy when they are asked to replace a cost accounting system with which they are comfortable with one that could dramatically change the definitions of success and failure (Ness and Cucuzza, 1995:130). Management may not have the commitment necessary and might not commit sufficient resources (Sharman, 1996:9). Other barriers include: entrenched cost management practices, inflexible legacy systems, inadequate procedures for managing information, and difficulties of integrating ABC with other financial management systems (Howard, 1995:14).

Some of these barriers are simple to address – management does not necessarily have to abandon current systems. The availability of cheap, powerful personal computers, spread sheets, and data-base languages allows the development of new cost systems offline from official accounting systems (Cooper and Kaplan, 1988:97). Others are not so simple – in order to be worthwhile, the total cost of operating using the old cost system must be greater than the total operating costs of the new system. The expense involved in designing a new system must be recovered through the reduction in the total cost of doing business that will be achieved. Given that the typical cost system appears to last for ten years or more, a cost system is obsolete and should be changed when the value of the benefits is greater than the redesign costs. This can be represented in graphical form as seen in Figure 5 (Cooper, 1988b:46).

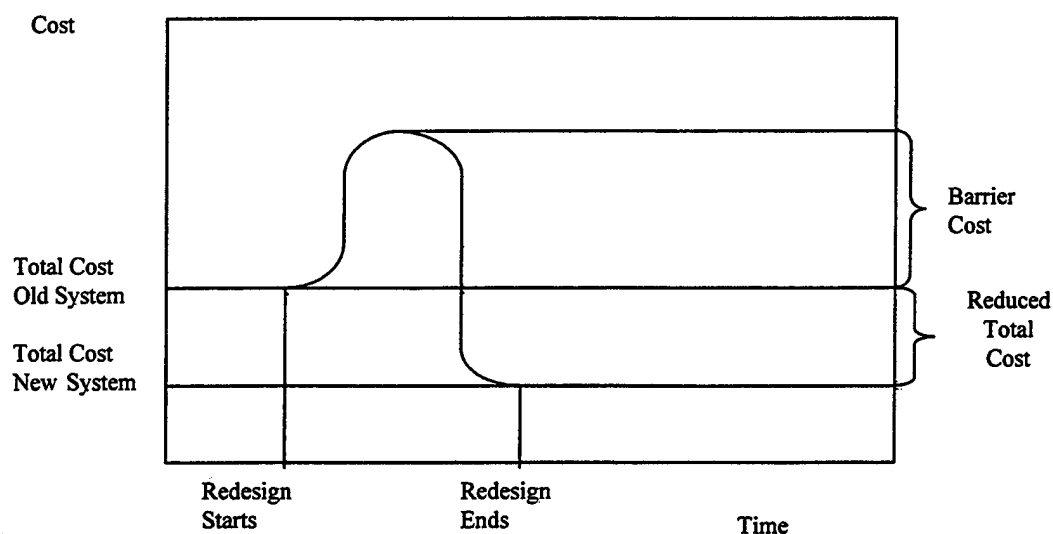


Figure 5: Redesign Costs as a Barrier

Implementation of an ABC system should depend on an analysis of the organization to assess whether or not it would be of any benefit. Will ABC show costs or other results that are significantly different from ones that could be generated with more conventional or less costly methods? If better information will be generated by the new system, will the new information change the dependent decisions made by management (Estrin et al, 1994:40)?

To determine if ABC is the correct course of action, a pilot study should be conducted involving the areas that are most likely distorted under the current system. Results should be significantly different from the results of the current system, otherwise ABC is probably not worth the associated implementation and maintenance costs (Chaffman and Talbott, 1991:18).

Another opinion is that there are three important factors in determining if the benefits of an ABC system exceed the cost of implementation and operation. These

factors are the sophistication of the firm's information systems, the cost of errors, and the diversity of the firm's products (Cooper, 1988b:41). In general, when there is a diversity of products, the cost of measurement and the cost of errors are inversely related. This is because the simpler cost system will impose low measurement costs, but the product costs that the system reports may be heavily distorted. A more complex system can report a less distorted product cost, but generally at a higher cost (Cooper, 1988b:41).

Some additional factors influencing the decision to determine whether ABC will be viable are the accuracy of the existing cost system, the type of management decisions that would be affected, where the sources of inaccuracy are, and the number of different processes by which goods or services are produced. If managers are aware of problems created by their existing cost system and are sufficiently concerned to want to correct the system, they must also be willing to assign resources to the task (Sharman, 1993:19). Again, the accuracy of a cost system may depend on the diversity of the product and processes. Types of management decisions that may be affected include changes in product mix, pricing changes, process changes, and organizational restructuring (Roberts and Silvester, 1996:26). Resources needed may include software packages, training programs, and possibly consultants.

Design of an ABC System

Without a champion, new concepts in business often fail. Senior management should understand and accept ABC; briefings and workshop sessions can be used to teach them about it. Introductory training in the concepts of ABC is often valuable for all employees, particularly when it is introduced (Sharman, 1993:19). Once employees understand ABC, they must also be convinced that ABC can succeed and that is worth the effort. In order to convince employees, each company needs to carefully construct a rollout that takes into account its culture and operating idiosyncrasies (Ness and Cucuzza, 1995:130).

Sometimes managers make a mistake thinking that activity based management is not a major organizational change program. Pinpointing the useful information about direct and indirect costs of a product or service can be a huge undertaking. Setting up the information system that can track those cost-contributing activities and then present them in formats employees can use is also a daunting task (Ness and Cucuzza, 1995:130).

Once the decision is made to implement an ABC system, an organization should form a project implementation team. The people on this team should have a strong understanding of the operations of the business; this almost always means involving staff from outside the finance department (Sharman, 1991:23). Not only will the members of the team understand the business better, but one of the tenets of ABC implementation is that the people who are going to be using the system must accept it.

There are two basic approaches toward implementing an ABC system. One is the top-down approach where the business processes are identified first, then the activities. The second approach is to start from the bottom by identifying activities first and then arranging them into business processes. The activities will normally be specified in detail for the departments and areas covered by the activity analysis (Miller, 1996:73). If the top-down approach is taken, it will ultimately require the detailed analysis at the lower level to validate, add, delete, change, and modify the initial definitions of activities and business processes (Miller, 1996:85).

Data needs to be collected in order to identify the resources the organization draws upon, the activities they perform, and the products they produce. There is also a need to identify the manner in which the activities consume the resources, and how products (cost objects) consume activities. There are many ways of gathering this type of data, all of which have advantages and disadvantages. It is relatively simple to identify the resources; an examination of the general ledger will reveal them (Miller, 1996:99-110).

Interviews are most common for determining activities, usually at the department level. This should enable the ABC system developer to gather good, detailed information. The interviews should not be limited to a small group; many different workers can contribute valuable information. For example, interviewing a department head can provide personal contact with management. Enough information may be obtained so that additional work may not be required. However, it does not involve the people who do the actual work, and it will only

provide a managers perspective. Quite often the individual employee knows much more about what makes his or her job difficult or complicated than the department manager. Interviews with departmental personnel can provide better information on tasks but is disruptive to day-to-day business. The interviews are also useful for deriving cost drivers (Miller, 1996:114).

Questionnaires can be used as an inexpensive method of gathering information. It will take very little time, but there is no personal contact and avenues of questioning may be missed. Questionnaires can also be subject to misinterpretation. The implementation team can also analyze diaries, time sheets, and check sheets. This can be an accurate way to identify activities, including the percentage of time spent on each activity. This method is time-consuming and can result in the perception that ABM is a labor reporting system (Miller, 1996:100-106).

According to Beaujon and Singhal, there are two high-level, fundamental processes in the design of an ABC system. The first process is disaggregating dissimilar resources, activities, and products to determine how heterogeneously activities and products consume resources. The second process is to combine similar resources, activities, and products to simplify efforts to gather data and interpret results. In this model, four design choices are required:

- Constructing resource categories;
- Defining the activity centers;
- Choosing the first-stage cost drivers; and
- Choosing the second-stage cost drivers. (Beaujon and Singhal, 1990:54)

Constructing the resource categories is often the simplest design step. It is usually pretty easy to track where the money comes from and how it gets spent from a general ledger. The aggregation and disaggregation processes can be seen at work in the construction of resource categories. For example, labor wages and employee fringe benefits may not normally be on the same ledger account, but it may not make sense to separate them when calculating the cost of labor. Since they are similar resources, aggregating them would make sense. This would then become the labor cost pool. Conversely, some resources may be used for multiple purposes that are not related and should be split up (Beaujon and Singhal, 1990:54).

Activity centers should be chosen on the basis of aggregating and disaggregating cost information. Ideally, an activity center is a discrete part of the production process; for example, in a manufacturing environment, it could be a stamping plant or paint room. Sometimes activity centers are not so distinct, such as a workstation where multiple tasks are performed. If activity centers represent different stages in the manufacturing process, then the resources that go into them should be split into separate cost pools. The cost pools will represent how much of each resource is consumed by the defining activity. Multiple cost pools associated with a single activity center should be grouped together as the total cost of that activity (Beaujon and Singhal, 1990:55).

Cost drivers are used to collect all of the costs associated with the various activities an organization performs, and transfer those costs to cost objects. A single cost driver can be used to transfer the costs of one activity, or they can be

used to transfer the cost of multiple activities. If all these activities that the single cost driver affects are similar in nature, they will often be grouped together in a cost pool. For example, if three different activities are all associated with setting up a machine for a production run and can be measured by the number of set-ups, then they would be grouped into a common pool and measured accordingly (Beaujon and Singhal, 1990:55).

Another factor to consider in the design is the tradeoff between the costs of measurement versus the cost of errors. This tradeoff implies that the most accurate costing system is not the optimal one if the cost of implementation is greater than the savings achieved (Cooper, 1988b:42). In order to find the areas with the greatest potential payoff, an analysis of indirect costs must be made.

Three rules should guide this process:

1. Focus on expensive resources.
2. Emphasize resources whose consumption varies significantly by product and product type, look for diversity
3. Focus on resources whose demand patterns are uncorrelated with traditional allocation measures like direct labor, processing time and materials. (Cooper and Kaplan, 1988:98)

Doing these three things will enable the personnel doing the implementation to apply their efforts where they will do the most good.

AFRL Structure

Now we will look at the structure of AFRL and its parent organization, Air Force Materiel Command (AFMC) and how AFRL/DE fits into it. In Figure 6 we see AFRL under the AFMC Commander (AFMC/CC) along with five other centers in AFMC.

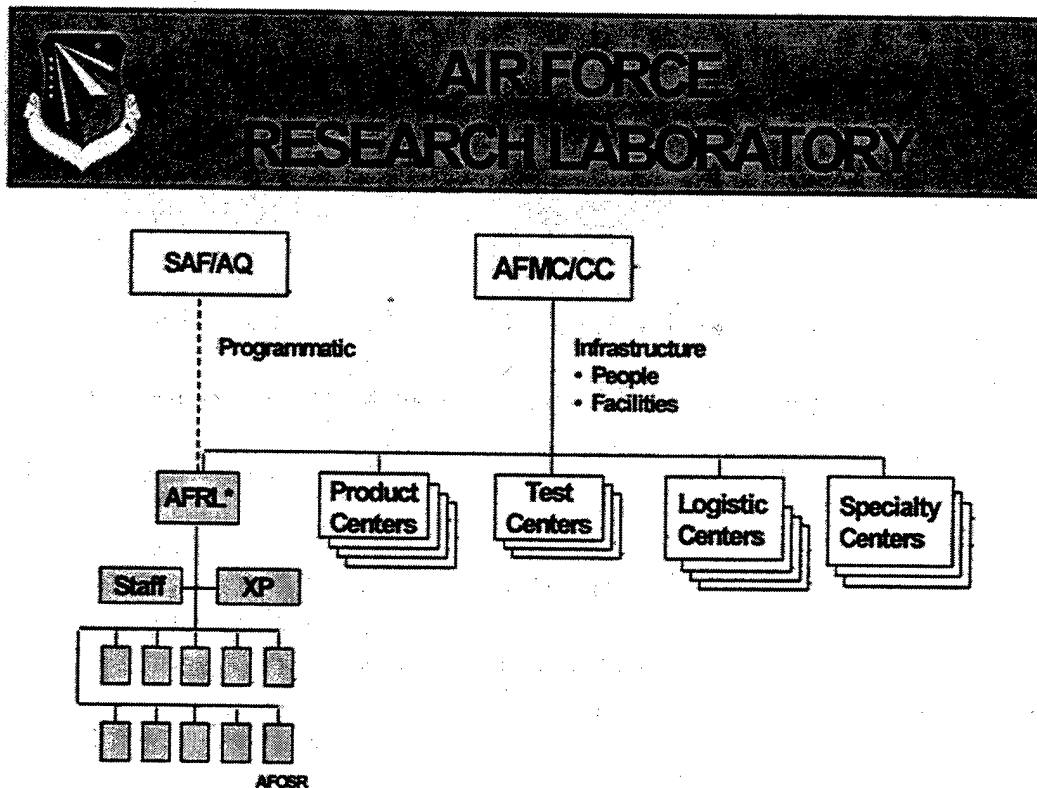


Figure 6: AFMC Organization (AFRL/DE, 1999)

AFRL is further broken down into sub-components to include the command section, the various headquarters functionals like financial management and

contracting, and the individual directorates. Figure 7 illustrates AFRL's organizational breakout.

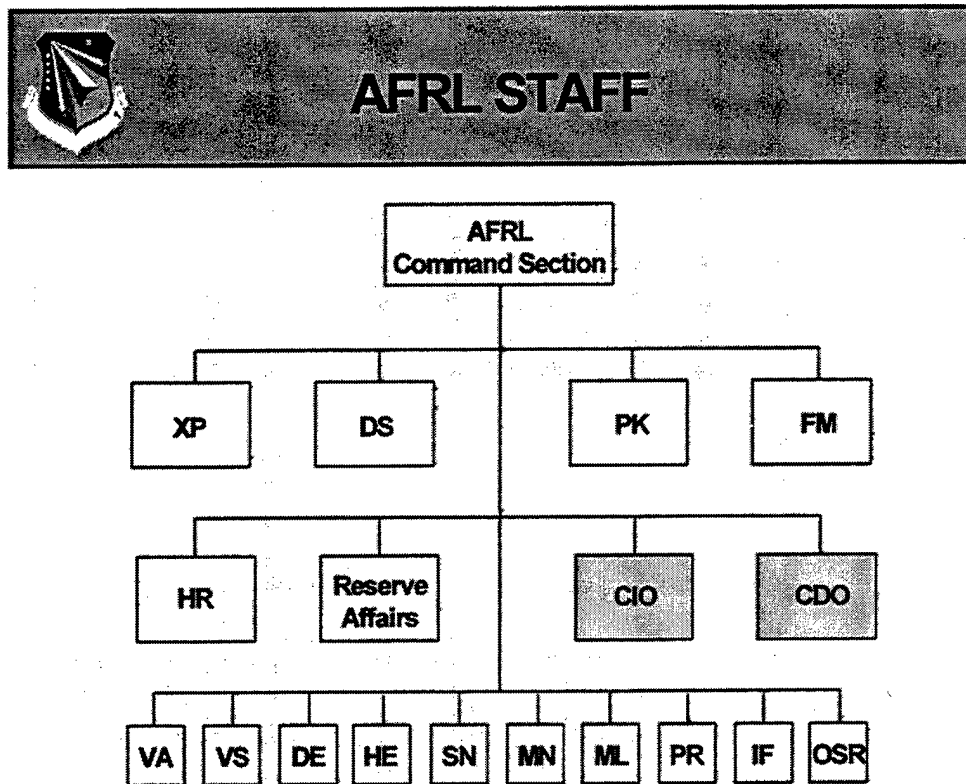


Figure 7: AFRL Organization (AFRL/DE, 1999)

According to Mr. Tom Weideman, AFRL Technical Directorates conduct research into wholly new technologies that may not be applied for many years, if ever. Sometimes the value of the research is to steer investment away from technologies that are apparently too cumbersome to be cost effective. Air Force research does not necessarily go to a specific product and is not normally economically traceable to a specific weapon system. In the case of the

laboratories, they want to be able to better define the costs of supporting the research process.

AFRL is implementing ABC in order to be able to better understand their total cost of operations. The total cost encompasses all Science & Technology (S&T) products and product support costs. Product support costs are those costs necessary to enable AFRL to produce S&T products. Figure 8 illustrates the percentage breakout of product support costs from total available funds. The unit cost as defined by AFRL is simply the percentage of funding that goes to support costs, not

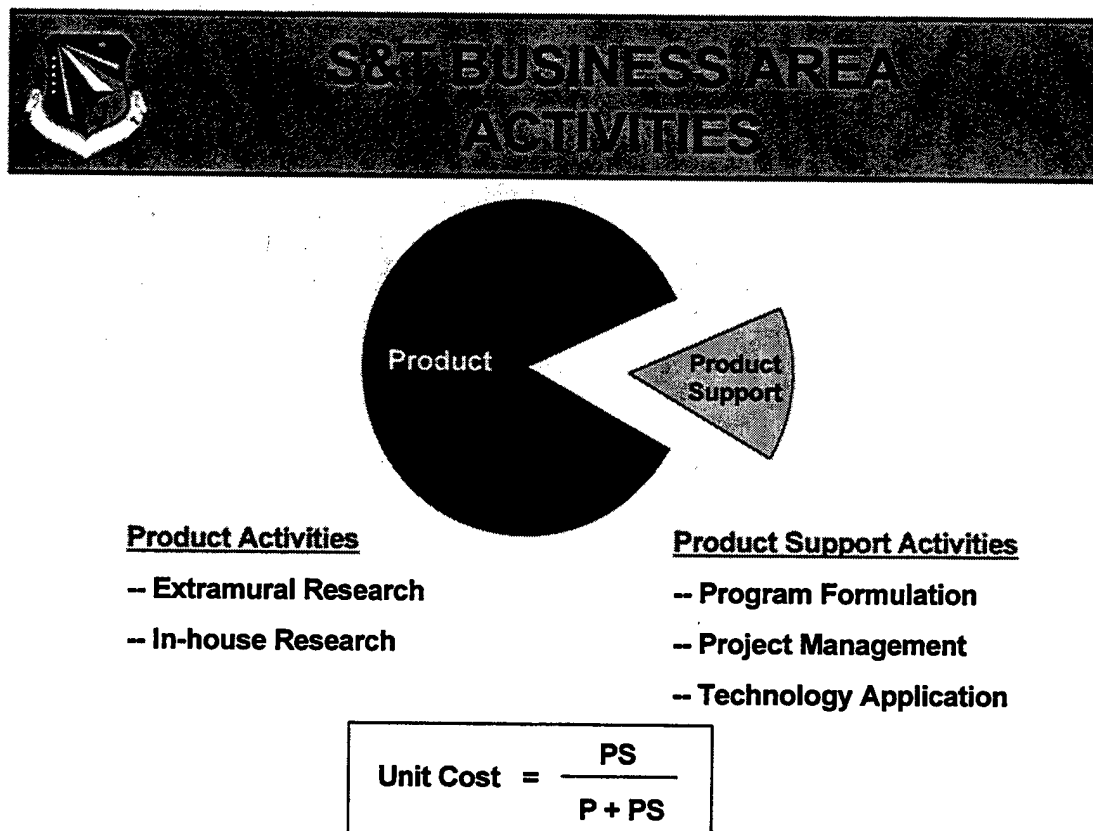


Figure 8: Percentage Breakout of Product Support Costs (AFRL Corporate Board, 1998)

research, and is therefore considered a “cost” of one “unit” of research. This ratio of support cost to total cost is a critical benchmark for AFRL. Since budgets are declining AFRL wants to maximize the amount of research that can be done with a given level of funding. Figure 9 is a pictorial representation of what is included in each of the two categories and the activities that AFRL/DE performs and on which its ABC system is based. AFRL has already put such a system in place and is currently implementing a second level. It should be noted that operations support costs are not included in the diagram as they are allocated into the three main

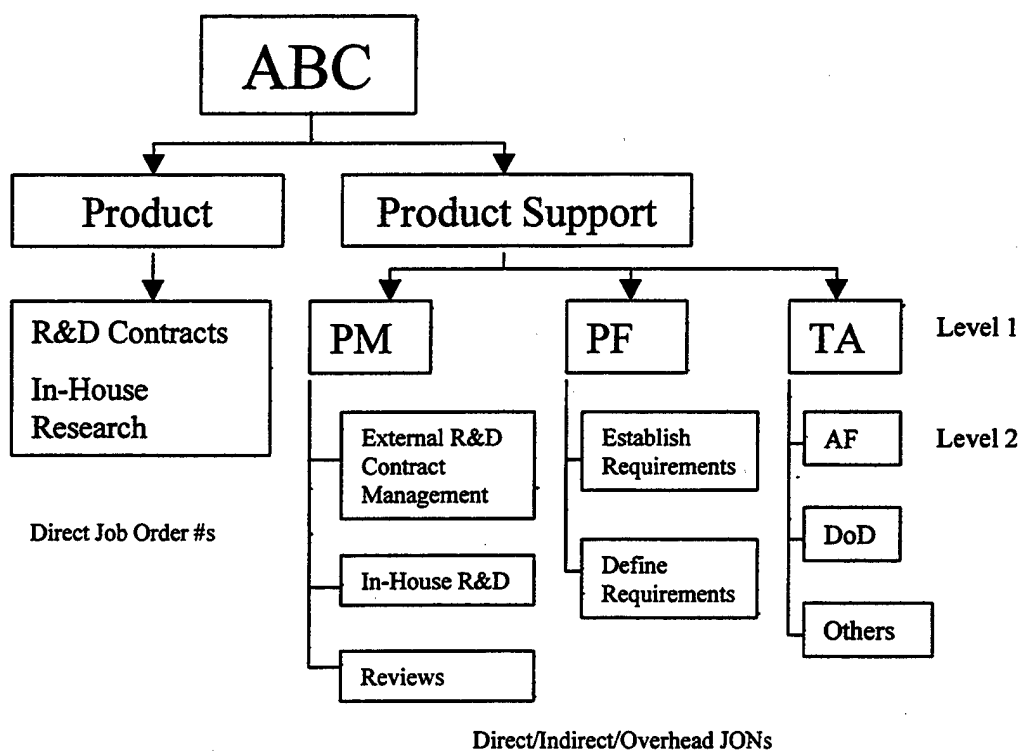


Figure 9: Pictorial Representation of Product and Product Support Breakout (AFRL Corporate Board, 1998)

support activities when the numbers are supplied to AFRL/HQ. They are distributed using the same labor percentage system described in chapter IV.

Level I: PM – Program Management PF – Program Formulation TA – Technology Application

The definitions of the activities are supplied in Appendix B. The descriptions include the level II activities.

Summary

This literature review looked at traditional accounting systems and highlighted some of the disadvantages of them by comparing them to ABC systems. We have shown how ABC can lead to better cost information, particularly in the context of a firm or organization with a diversity of products that do not consume resources in a uniform manner. We briefly described some of the barriers to implementing ABC and what to evaluate to determine if it should even be done. Then we examined some of the issues and design choices involved in constructing an ABC system. Finally, we looked at the current structure of AFRL/DE's activities.

III. METHODOLOGY

Introduction

AFRL is currently implementing an ABC system. Our team used this initial implementation as a springboard for our research. Through our research, we will be able to critique the current ABC model and provide suggestions for AFRL to use in further implementation efforts.

In this chapter we provide a step-by-step process detailing what information we obtained and the process through which we obtained it. First, we explain our research design and methodology for data collection. Then, we describe both the organizational involvement and data we needed to collect to comprehend desired model development inputs. In the next section, our research objectives were used to formulate the research questions we intend to answer. We also address our interview process to include who was interviewed and what we hope to learn by our subjects' answers. We did this in part by creating a matrix that illustrates how our data collection process ultimately provided answers to our research objectives. Finally, we conclude this chapter by detailing how we analyzed our data, to include content analysis.

Research Design

A research design has three main parts:

First, the design is a plan for selecting the sources and types of information used to answer the research question or objectives. Second,

it is a framework for specifying the relationships among the study's variables. Third, it is a blueprint that outlines each procedure from the hypothesis to the analysis of data. The design provides answers for such questions as: What techniques will be used to gather data? What kind of sampling will be used? How will time and cost constraints be dealt with? (Cooper and Emory, 1995:114)

In answer to the first part of a research design we performed exploratory research. Exploratory studies tend toward loose structures. For instance, when interviewing subjects, we needed additional latitude to use qualitative questions by asking for opinions; furthermore, we needed the ability to ask follow-up questions when an interesting tangent relating to our research data arose. Exploratory studies are also used when researchers are concerned about providing specific detail for future research tasks. This type of research parallels the research objectives we investigated as described in the first chapter:

- Determine the overall motivation for implementing ABC for AFRL headquarters and at the Technical Directorate level
- Determine how the information is actually being used at the TD and HQ levels compared to stated motivations or objectives
- Appraise AFRL's overall ABC model appropriateness and potential for providing AFRL's needed information by comparing their existing model to standard ABC practices. Evaluate current model's structure, resources, activities, cost objects, cost drivers, cost pools and allocation bases in light of accepted ABC models and AFRL needs

- Understand and evaluate AFRL/DE's unique that are being injected into the current AFRL model with regard to the potential for standardization
- If deficiencies are found, provide suggested improvements and guidelines on how to formulate adaptations for individual TDs
- Provide a foundation and direction for future research

Furthermore, exploratory research helps the researchers develop the initial problems more clearly, establish priorities, and improve the final research design (Cooper and Emory, 1995:118). Likewise, our research team examined a newly emerging way of accounting for costs within AFRL and is attempting to more clearly define the needs of the users and provide suggestions for future research and implementation efforts.

The purpose of our research is descriptive in nature. Descriptive research is used when the researchers are trying to find out who, what, where, when, how, or how much of a topic (Cooper and Emory, 1995:120). Throughout our research we are ascertaining various data relating to descriptive research. For example, our research team asked questions such as: Who is the primary user for the ABC information? What level of information do they need in order to make informed cost reduction decisions? How are those decisions currently being made?

When conducting research, different data collection methods are available. Qualitative or quantitative data collection techniques are the two broad methodologies generally applicable to research. Our research appeared to be non-quantifiable in the way in which we are appraising a system's appropriateness

by relating it to general practices and performance concerns. Furthermore, due to the exploratory and descriptive nature of our research, a qualitative research technique was appropriate. We accumulated information on an emerging system that called for a certain amount of subjectivity in categorizing subjects' responses. Furthermore, two more reasons for a qualitative approach to research are to gain familiarity or insights and description (Neice and Scribner, 1996:41), both of which were appropriate to our research.

In order to successfully perform our research we utilized both primary and secondary data. A majority of our secondary data was collected and analyzed during the first half of this research effort. Secondary research is comprised of studies made by others for their own purposes. We utilized both internal and external forms of secondary research. Internal secondary research was supplied by AFRL and AFRL/DE while external research was primarily made up of periodicals and books. The majority of our primary data was accumulated during the second half of our research. The principal vehicle to collect our primary data was the interview process. We used predetermined but open-ended questions to collect our primary data. Face-to-face interviews were used; however, telephone calls were also used for asking follow-up questions.

Interviewing errors, such as non-response and response, were limited in our research. We believe non-response error was limited because we were able to talk with all the individuals that we felt were appropriate and when interviewing these individual they were fully cooperate with us. However, there was one exception;

due to their lack of response, we were unable to obtain data from a TD located at WPAFB. It is possible that this TD could have been an outlier and skewed our results. Inaccurate response errors were also possible. However, we attempted to mitigate this potential error by cross-checking interview answers among each other and with any relevant internal documentation we had acquired from AFRL. We then looked for outlying answers to our questions and assessed them for validity or possible error.

Organizational Involvement

A substantial portion of our secondary data and the entire portion of our primary data was accumulated through AFRL, AFRL/DE and AFRL Technical Directorates at Wright-Patterson AFB. In order to collect needed information we needed their cooperation. The leadership's active involvement was instrumental in allowing us to accumulate both the primary and secondary data needed for thesis completion.

Along with internal ABC documentation, we conducted interviews with personnel, primarily at the directorate level. We divided the interviews up into two parts. We conducted a screening of our interview questions locally at AFRL/HQ. After this initial screening, our interview questions were amended to include any notably missing subject matter and to amend unclear questions. At this point our interviewing was conducted at the TD level. The majority of the interviews were conducted with AFRL/DE personnel; however, we interviewed three ABC points of

contact within two different directorates located at WPAFB and one ABC focal point at AFRL/HQ. These additional subjects helped us address our standardization questions and validate our data collected at AFRL/DE. In order to perform face-to-face interviews, we required AFRL/DE to supply TDY funding for our research group. Only one trip was necessary to collect the needed data.

A structured interview process was followed for each subject. All attempts were made to supply the interview questions before the interview. The interview questions were sent to DE before the interviews were conducted. We asked that each interviewee be given a copy of the interview questions so that he/she would be familiar with the questions and would understand the type of data we were attempting to collect. Also, each interview was structured in a way whereby the interviewee was allowed to elaborate on questions asked. This interviewing style encouraged open-ended questions that limited finite answers and encouraged open-ended discussions. We used a small tape recorder to help eliminate transcription or note-taking error. At this point, we confirmed to the interviewee that we were strictly doing research and that their anonymity would be protected. Due to confidentiality, top-level support, and pre-selection of interviewees, we did not anticipate any interviewee permission problems concerning the usage of a tape recorder or answering any questions, and no problems developed. Each interview was scheduled for a maximum of 60 minutes to minimize the imposition on the subject's time, thereby helping to maintain a good relationship throughout the entire interview.

AFRL/DE's help was essential in obtaining TDY funding and coordinating the interview process. Two options were available for interviewing the subjects. First, the point-of-contact (POC) at AFRL/DE could set aside an interview area and assign subjects to sixty minute time blocks for conducting the interview. Second, our interviewing team could be guided around the office area stopping at each subject's workstations at the appropriately scheduled time. The final selection of which method to use was determined by the hosting organization according to what they believed would work best in their organization. We held most interviews at the subject's personal workstation. Leadership-level support was needed to ensure the interview schedule was filled with selected personnel as explained in the next two sections of this chapter.

The following section of this chapter incorporates some additional literature review. This review is more focused on the specific factors we looked at within AFRL's ABC implementation effort. This information guided the development of our research matrix and interview questions referenced at the end of this section.

Desired Model Development Inputs

Initial Information for Successful ABC Implementation. Implementing a full-blown ABC system without preparatory work is ill advised. Usually either a pilot study or staged implementation is conducted to save time and money before full ABC implementation is begun (Rutgers, 1998). Therefore, in an effort to critique AFRL's current model and provide suggestions for future ABC efforts, we

approached this as an ABC pilot study. Different ABC solutions are available depending on the final objectives of an organization. Once the system's objectives are determined, several questions need to be answered before the study moves forward:

- Who will own the new ABC system?
- How complex and detailed should the system be?
- What degree of accuracy is required and what level of precision will it produce?
- Will the system be integrated into the day-to-day financial accounting system, or will it be a stand-alone system?
- What approach to the cost assignment view should be taken: Two-staged approach or a multiple-staged approach (Institute of Management Accountants, 1998)?

Furthermore, Michael Shields and Michael McEwen conducted a survey that showed several factors were highly correlated to a successful ABC model. These factors were:

- Top management support
- Linkage to competitive strategy, especially quality and JIT/speed
- Linkage to performance evaluation and compensation
- Consensus about ABC objectives
- Training:
 - Training in designing ABC systems,
 - Training in implementing ABC systems,
 - Training in using ABC information (Shields and McEwen, 1996:17)

It is appropriate to reiterate some significant factors to understand when developing an initial ABC system. First, an ABC system must be consistent with the organization's business strategy and needs and there must be participation and cooperation from all affected areas of the organization. Second, all affected functions of the organization must participate in the ABC system's development

and implementation in order to foster commitment to the new system throughout the organization and also to improve the design of the new system. Finally, the system will not be effective unless users understand the new information that ABC provides.

Gathering the Information. Both conceptual and statistical types of information should be collected when gathering information for the implementation of an ABC system. Conceptual information is required in order to develop the overall design of the ABC system and comprised the bulk of information we collected. The goal of the data-gathering activity is to accumulate the information necessary to:

- Identify those activities performed by the organization
- Identify the organization's element of cost and performance measures
- Determine the relationships between the various activities and elements of cost
- Identify and measure the cost drivers that determine the cause costs to flow into activities and cause accumulated activity costs to flow to other activities or to the organization's products and services (Institute of Management Accountants, 1998)

Identifying an organization's activities is important when implementing an ABC system. When identifying activities, there are typically a large number of activities to select from. The selection process should be guided by the objective the organization is attempting to achieve. The cost/benefit, in terms of difficulty and cost of obtaining information, will also determine the activities the ABC system will use. When an ABC system's objectives are strategic, their primary

need is to provide accurate assignment of cost to cost objects (Institute of Management Accountants, 1993).

Identifying elements of costs or resources are essential when developing an ABC system. Resources are usually derived through general ledger accounts. We used the resources currently being tracked by AFRL. However, we would suggest amendments to the resources currently being used if, through our analysis of the interviews, we found applicable resources that are not being used.

Once the resources have been identified we must assign the resources in the general ledger to activities. Resources can be assigned to activities by charging them directly or through estimation. Directly charging costs is preferred if it is deemed economically feasible. In other words, if the dollar amount is large and data is easily obtainable then all efforts should be made to directly charge the resources being used. By contrast, if costs are small or very hard to obtain, then estimation is the preferred method to use when assigning costs.

Cost objects must also be defined. Cost objects may be the organization's products or services. Regardless, cost objects should ultimately be the causation for the occurrence of costs within an organization.

Developing cost drivers is last. This step is especially difficult because decisions must be made as to the trade-offs between cost accuracy and the difficulties of operating a more complex costing system (Institute of Management Accountants, 1993). As more detailed cost accuracy is required, the more complex an ABC system needs to be. This complexity may cause added expense for

implementing and maintaining an ABC system. Therefore, trade-offs must be made between the level of cost accuracy need and the complexity of the ABC system.

Interviews. Historical records, documentation and literature, and data collection through interviews are the major methods we used for accumulating ABC data. Most ABC implementation plans incorporate multiple data collection methods. However, interviews are an important part of data gathering and represent a significant portion of the resources consumed in the ABC implementation effort. Usually 5 to 15% of the total employees are utilized during the interview process to identify activities, cost drivers, performance measures, resource drivers and activity drivers (Miller, 1996:99). Both department heads and department personnel are commonly interviewed during the data collection stage. We interviewed those responsible and most knowledgeable in the current ABC system. We also interviewed department heads, financial analysts who work with ABC and pertinent program managers. Who was interviewed will be further explained in the next section of this chapter.

When attempting to accumulate data for implementing a detailed ABC system, interviews should be conducted in two parts, each part may take up to two hours. This type of research is for defining all the individual parts when developing a specific system. Therefore, it is a very involved and rigorous search for details. This type of research is outside our scope. Our interviewing process did not require such an in-depth interview process due to the exploratory and top-level nature of

our research. Our interviews were approximately 45-60 minutes in length per subject and utilized more abstract questions than an interview aimed at determining very detailed activities and cost drivers.

Interviews were our primary vehicle for collection of information. The main source of potential error comes from the interviewee not understanding terms or questions being asked by the interviewer. Therefore, we supplied our questions in advance along with a glossary of terms.

When developing the intricacies of a complicated model, questions must be carefully designed to be effective. Our research is focused on a more abstract level of AFRL's ABC system; therefore, a moderately structured interview provided dialogue that led to important insights.

Interviewing and Question Formulation Process

As indicated previously in this chapter, we performed face-to-face interviews with approximately thirteen individuals from AFRL/DE. These individuals provided us with sufficient primary data; however, all thirteen of these interviewees were from the same organization and thus were insufficient to fully answer our standardization concerns. Therefore, we spoke with four more ABC qualified individuals located within different TDs and AFRL/HQ located at WPAFB. These additional interviews outside AFRL/DE's environment helped us further understand any problems concerning standardization among the directorates and

validate our research collected at AFRL/DE. To reiterate, face-to-face interviews were our ideal choice, but we used phone interviews as the need arose.

Selection of interviewees was critical for collection of useful information. Managers, workers and internal ABC experts are the critical positions to interview (Miller, 1996:109). Therefore, our ideal interview candidates stemmed from three distinct disciplines in relation to ABC; those in the positions to use ABC data, those performing the activities incurring costs, and those who were responsible for the implementation or maintenance of the ABC system. We interviewed a minimum of two people from each level of AFRL/DE's management: directorate, division and technical area. We also talked with three individuals who were responsible for the maintenance and information dissemination of the ABC model, and finally two individuals in a position to use the ABC information for decision-making. The individuals from the technical divisions included both division chiefs, who have a broad overview of their entire working group, and workers like program managers. AFRL/DEOF's assistance in organizing an interviewee pool of individuals was invaluable.

After the appropriate interviewees were determined, the creation and selection of appropriate interview questions were vital to successfully address the problem statement. In an effort to illustrate a direct logical flow from our research objectives to our interview questions, we created a traceability matrix. This matrix is provided in Appendix C and illustrates how each of our research objectives flows to research and investigative questions. Corresponding interview questions are

listed on the right side of the matrix. A copy of the ABC Questionnaire and the Research Traceability Matrix are located in Appendices B and C, respectively.

This matrix illustrates a direct correlation between the questions we asked and the research objectives we intend to answer. Through our research objectives we formulated research questions in the second column from which in turn were derived investigative questions. Those investigative questions are directly associated to the questions we asked our interviewees. Therefore, the quality of our matrix and essentially our interview questions determined the quality of our research. Due to the qualitative nature of our research, we did not use any statistical means to validate our questions. Instead, we validated our questions by having knowledgeable faculty members at AFIT and a representative from AFRL/HQ critique our questions concerning their appropriateness and provide us with feedback, which we incorporated into our matrix and questions. The faculty members had knowledge in areas of accounting, ABC, military structure, and general business and DoD practices. An AFRL/HQ representative was able to evaluate the questionnaire with respect to its applicability to AFRL.

Analysis of the Collected Information

Through the data collection process, we collected two types of data. Our primary form of data was gathered through interviews. Our second form is comprised of internal communications, to include interdepartmental memos and briefings. Validation of our primary research was done in three ways. First, we

asked multiple people the same question and looked for common responses.

Second, as we went through the transcribed protocol, we attempted to ensure that any similar questions being asked had similarity in their responses. Finally, we compared answers to existing internal AFRL documentation. The validation process occurred concurrently as we formatted our data for inclusion into Chapter IV. In the case that we were unable to validate a response, we included it and noted that the data is either suspect or an outlier.

After collection of our primary data, we converted the recordings into text. The transcription process is fraught with potential for minor mistakes through human error and misunderstanding the meaning of the interviewee's responses. We attempted to ameliorate this problem by transcribing the interviews ourselves, thereby minimizing the impact of minor mistakes occurring during the transcription process. Both the conduct of the interviews and the transcription into text helped us recognize any minor mistakes and interpret them correctly. For example, we were more likely to recognize a transposed number and interpret that number for its true value. Furthermore, by transcribing each tape within a reasonable amount of time (a mean of 10 days), we hoped to recall each interviewee's general non-verbal attitudes and reactions. Remembering their general attitudes when analyzing the data provided us with added insights into each interviewee's response. Each subject's response were transcribed verbatim with the exceptions of non-value added dialog. Also, if an interviewee's answer went on a tangent and clearly did not pertain to the question asked or ABC in general, the verbatim transcription was

stopped and a note was made in the transcript to indicate the reason for the stoppage. Furthermore, the tapes will be kept in case that dialogue is deemed necessary at a later date.

After the interview process was completed, we had an extensive amount of verbal data. As previously mentioned, we recorded the interviewees' answers to the interview protocol, which provided us with approximately 12 hours of verbal data. We then used Word Perfect for the transcription process. Both manual transcription and voice recognition software were used to convert the recordings to written data. The written transcription was formatted in a similar manner to the interview protocol. There is a number that corresponds to each question on the interview protocol. Also, each interviewee was assigned a subject number. As the recordings were transcribed, each response was written out under the number that corresponds to the question being asked and labeled with the interviewee's specific subject number. In order to provide complete anonymity to the research interviewee, the transcriptions were not included in the final thesis.

Once this transformation was made, content analysis was our primary analytical tool for sorting or categorizing the data into manageable groups and for analyzing and interpreting the data. Content analysis is a systematic research method for analyzing textual information in a standardized way that allows evaluators to make inferences about that information. In essence, content analysis is a systematic grouping of related themes or ideas whereby a researcher can identify key ideas by using an alphanumeric coding system. This system breaks

down large quantities of written material into groups that are related and more manageable, thus helping summarize and analyze the written data (Weber, 1990:9).

We used codes to summarize and analyze our data. Codes are identifiers for assigning units of meaning to the descriptive information compiled during a study (Miles and Huberman, 1994:56). Our codes took the form of highlighter colors with each color indicating a different kind of response. Ideally, some form of coding should have taken place before all the data has been collected. We did not develop a coding system prior to data collection. However, after conducting each interview, we did discuss various themes as they were brought forward. Then, after the transcription process was complete, we analyzed all the various responses to each interview question and assessed each response for common themes, phrases or ideas. Once we had categorized all the responses to a particular interview question, we grouped each theme primarily by the frequency with which it occurred. This process was done for each interview question. After all the interview questions were examined, we analyzed each investigative question, derived through our research matrix, by reviewing all the corresponding interview questions that were related to it. Then, in Chapter IV, we summarized each frequency-based grouping for each research question, thus providing the groundwork for answering our research objectives.

Summary

This Chapter provided our methodology for obtaining information to provide suggestions for an updated AFRL ABC model. First, we specified the kind of research we intend to conduct. After careful examination of available research methods, we decided to conduct exploratory research obtaining qualitative data. We used a variety of data collection devices. However, our primary data collection technique for obtaining undocumented data was personal interviews among AFRL/DE's staff and in other AFRL organizations. This chapter makes note of a detailed research matrix in Appendix C that shows our question formulation process by tracing research objectives to actual interview questions. This chapter also references Appendix B, which contains the interview questions. These questions were derived to ultimately answer our research objectives. Finally, this chapter concluded by showing how we analyzed the data after it was collected.

IV. FINDINGS AND ANALYSIS

Introduction

In this chapter we will present the findings and analysis of our research study. The findings and analysis are presented in a manner that summarizes research questions in order to answer research objectives. Therefore, this chapter will list research questions and provide a summation of pertinent data given by our research interviewees. Appendix B provides a complete list of our interview questions, and Appendix C provides our research matrix that shows the relationship between interview questions and research questions.

In order to answer our research questions, we developed a traceability matrix that used research objectives to develop research questions; ultimately this led to investigative questions and finally interview question development. This next section of Chapter IV will analyze each of the research questions we posed. We listed each research question under each research objective in the order found within our research traceability matrix.

The same interview protocol was used at various personnel levels. For example, we interviewed personnel from headquarters located at Wright-Patterson AFRL, from headquarters at an individual TD, individual TD finance personnel at the top level, division level management, and technical level management. As we answer the following research questions, we will separate the responses into three different levels when applicable to make apparent any noticeable differences in

the responses. The levels are AFRL Headquarters, TD management, and Division management. For certain questions, such as the structure of the model, in which separation is unnecessary, we will simply describe the collected data.

Research Objective 1

The first two research questions were so closely related that we put them together:

What was AFRL's motivation in implementing an ABC model? And what was the motivation for various TDs in implementing an ABC model?

Headquarters Level. The implementation of ABC was top-down directed. The "top-down directed" is a very strong theme reflected at all levels. According to an interview held at AFRL Headquarters, General Babbitt indicated that he wanted AFRL to operate like a business; in particular, he wanted cost visibility to see how much was being spent on support costs and thus be able to reduce that cost of doing business. Therefore, a basic ABC model that would capture the three support areas of doing business was developed at a top level and directed downward. The original purpose of the ABC system was only to gain cost insight into areas where costs were controllable. Hence, a construct was developed that collected all the support costs by Program Management, Program Formulation, and Technical Application and compares that number to the money being spent for product (direct research dollars) to give a percentage of product support to product dollars being spent.

Directorate level. At this level eight people expressed opinions. Three of the respondents believed that the motivation was to cut infrastructure costs. The other five agreed that the motivation for implementing ABC at the directorate level was because it was a top-down directed program. The majority agreed that the concept of reducing support costs via ABC information is realistic, however, the current model being used is unanimously viewed as being unrealistic for achieving its goals.

Division Level. At the Chief and Deputy management level, ABC is viewed in a similar light as at the directorate level. However, there is a consensus that ABC is not very useful. Most employees at this level are unaware of ABC's existence, and the employees who are familiar with ABC do not believe that it is a usable system. To illustrate, one division employee said that ABC was transparent to him and that he still budgets and tracks costs the same way he had always performed those activities in the past. Basically, most employees at the Division or Technical Area (TA) levels are unaware of the reasons for ABC implementation.

Do decision-makers perceive a need for the information provided by an ABC system?

Among our respondents, a 2/3 majority felt that there was no pressing need for any new type of accounting system to aid decision-making.

Headquarters. In AFMC and AFRL there is a demand for the information being generated. Executive management at these levels wants to understand the

costs of doing business, and wants the data as a benchmark for observing changes in costs over time.

Directorate. A common theme at this level is that the information for ABC must be compiled in order to fulfill the top-down directed requirement. However, besides the fulfillment of a requirement, ABC is not viewed as useful information; therefore the implementation and data gathering process was universally viewed as "filling a square".

Division. Again, the current ABC information is not perceived as needed or useful information. In fact, most ABC or other financial taskings at the division level are viewed as time taken away from more important matters; any time spent doing support activities is time taken away from research. However, there is a perceived need at this level for better cost information in general. The current system is viewed as incredibly slow and unable to deliver insightful information for cost reduction decisions.

Research Objective 2

Is the current ABC system providing qualitatively different information than the previous accounting system?

Headquarters. At the headquarters level, the information provided by the individual directorates is compiled into a construct that illustrates how much of a directorate's funding is being spent on product support compared to actual product. This construct was previously unavailable under the previous reporting

format and therefore is different under ABC, but not in a substantive manner. As one AFRL interview subject put it, "I am not sure if any of it is different than what we were getting; it is just in a different format."

Directorate. At the directorate level, they view the information being provided by the ABC system as not being qualitatively different in comparison to the information that was being gathered before ABC implementation. First, the information used to complete the ABC template is derived through the same systems as the old data. Within the directorates, no new processes or software systems were put into place before or after the implementation of ABC. Second, the manner in which their ABC model is formatted was directed from higher levels. The information that is being collected does not wholly reflect how the individual labs would be performing ABC if they did not need to satisfy higher headquarters' requirements. To illustrate this point, a high-ranking member of one directorate stated, "ABC just does not track costs the way we do business and until it does that, it is going to be hard to use."

Division. The division level does not receive any ABC information. In fact, most personnel within the division are unaware of ABC's existence. At the higher levels of the Division, they are aware of ABC's existence, but it does not provide them with any cost reduction or decision-making information. Therefore, they are using the same financial information as before to make decisions.

Who receives the information generated by the system?

Virtually every respondent able to answer the question, regardless of what level, indicated that 1% or fewer of AFRL's personnel actually work with or are privy to ABC information. The other respondents, who did not state 1%, were basically unaware of who worked with ABC and consequently were unable to answer the question. Among those employees who do not work directly with the financial system, only a small group of higher level management personnel are aware of ABC's existence. Among the people who collect the accounting data the common perception is that the ultimate users who receive the ABC data are General Babbitt or General Paul. At this point, all the ABC work is being compiled upward through AFRL in order to build briefing charts that contain a small number of very top level numbers, and it is at that level that the information is actually received in its final form.

Headquarters. At the headquarters level, one person is the main focal point for ABC within AFRL. He has assistance when needed, but he is the POC for all of the TDs. He answers questions, disseminates guidance or lessons learned and combines the current ABC data into simplified briefing charts that will be briefed up the chain to the command level at AFRL and AFMC. ABC data is not disseminated outside the circle of financial managers and is even limited within AFRL/FM.

Directorate. Typically two or three financial managers are responsible for the implementation of the ABC system and accumulation of the ABC data within

each of the directorates. They attend quarterly meetings and disseminate any pertinent information from those meetings to their leadership and small working groups. However, most information is accumulated and kept within a small group of financial personnel.

Division. No ABC information is disseminated or gathered at the division level. At various times division workers have been asked to contribute to the ABC system by completing a survey or attributing their working time to ABC-coded job order numbers (JONs), but they are unaware of any benefits or available data that ABC may be providing. A quote from a lead engineer, who is working at the level that actually incurs much of the day-to-day costs for in-house research, shows that the potential benefits of ABC are not apparent to AFRL's division-level workers: "Whether ABC is doing the tracking or something else is largely immaterial to us."

Are there any differences in the decisions made as opposed to the decision that would be made were the legacy system still in place?

ABC is not being used for any decision making within AFRL. Every respondent indicated that ABC was not being used to reduce costs. In fact, the common perception is that current cost cutting is being conducted the same way in which it always had been conducted. There have not been any changes to the way decisions are made since the implementation of ABC. At the directorate level they are very skeptical that the current ABC information is even usable for

decision-making. They believe that ABC is purely a financial tasking that provides a number to higher-headquarters for AFRL executive-level decision-making. They are unsure if the current ABC structure is suitable to be used at the lower levels for cost reduction, but we did substantiate that ABC is not currently being used, in any capacity, to reduce costs at the division level.

At the Directorate level, AFRL is making some decisions with regard to ABC. However, those decisions are not cost reduction decisions but formatting decisions of what goes into either product or product support. First, the directorates determine which funds go into each group; then they find ways to reduce the ratio. They believe all decisions and evaluations will stem from the ratio and their ability to lower it. Therefore, the incentives are not so much to reduce costs, but rather to put costs into product whenever remotely justifiable. AFRL/HQ has the concern that various decisions being made, when moving funding between product and product support, may actually be cost inefficient but will make the individual TD's ratio appear better. For example, by simply attributing travel to a specific contract, the cost of that trip will be placed in product instead of product support. This will lower the ratio and give the appearance that the TD is using less funding for support, when in fact no cost saving initiatives have taken place.

Research Objective 3

Does AFRL/DE's ABC Model conform to standard practices with respect to the implementation and operation of their system?

We looked at conforming to standard practices in two forms. First, was the implementation of their ABC system performed in a manner that would be conducive to a successful ABC system? Within implementation, we appraised training, top management support, consensus about ABC objectives, linkage to performance, ownership of the ABC system and type of integration within the organization. Second, is the structure of how the model operates appropriate?

Within the category of implementation appropriateness, we found the following facts. Less than 1% of AFRL's personnel were involved with the development and implementing of AFRL's current ABC system. Not one respondent was trained about ABC prior to implementation; however, after ABC's original implementation, some ABC training was provided for higher-level members of AFRL. Both middle and top levels of management are supportive of ABC. However, that supportive attitude is not reflected throughout the organization as employee buy-in into ABC. Every respondent indicated that most AFRL employees would not even know what ABC is, and most of those who do know of ABC view it as a financial tasking. In fact, headquarters stated, "each TD had a representative and each representative was a financial type versus an engineering type, which I personally think there should have been some

engineering folks involved in this thing versus a bunch of financial bookkeepers.” Each of the TDs we interviewed also indicated that ABC was viewed as a financial responsibility and handled as a single-functional manner. Finally, all the TDs said that ABC was not linked to performance evaluation of individuals; however, they are concerned about TDs being compared with one another based on the unit cost of research (recall that AFRL defines “unit cost” as product support costs divided by total costs).

We found several concerns with appropriateness of the current ABC model’s structure. The product and product support categories were developed at higher levels. The individual TDs had to develop the ABC system around these parameters. Also, the three main categories within product support were also directed by higher-headquarter. The TDs were then instructed to develop an ABC system in accordance with these various groups. The individuals responsible for developing the ABC system from this point on were all single functional and lacked any formal ABC training. One of the biggest indicators for the ABC system’s lack of suitability comes from the fact that not a single person we interviewed is using the information for cost reduction or decision-making.

The financial systems used to support ABC are also a concern. When ABC was first conceptualized it was supposed to be implemented utilizing existing systems with no specific ABC software. Therefore, the TDs are extracting information out of the accounting systems the same way they always have. Then they format the data in an Excel™ spreadsheet in a way that conforms to AFRL’s

template. This data does not appear to be providing the TDs with better information. Two AFRL employees said, "I am not sure any of it is different than what we were getting, it is just in a different format" and "It's just a combination of a lot of different reports."

Is there opportunity for feedback?

Headquarters. The headquarters perspective is that the ABC system is not being used, nor is it meant to be used, as a performance evaluation tool. There is no particular mechanism or avenue identified for feedback to the headquarters, aside from the quarterly Business Area Team (BAT) meetings. These meetings are a natural forum raising issues to do with the system's operation or structure. AFRL/HQ believes that the BAT meetings should encourage "cross-pollination" ideas for improvements or ways of using data provided between TDs.

Directorate. There was unanimous agreement between the directorates that the ABC system is not being used for performance evaluation. Additionally, just like AFRL/HQ, the financial managers from the TDs felt that the BAT meetings are an opportunity to air grievances or suggest improvements. Some felt comfortable with simply picking up the phone and calling AFRL/FM if they had any issues to discuss. There was disagreement as to whether or not improvement suggestions were encouraged. Some managers were convinced that any suggestions would be dismissed out of hand. Other managers felt that there was no solicitation of feedback, but if given, would not be automatically rejected.

Division. At the divisional and Technical Area level the managers agreed that ABC was not being used for performance evaluation. There was also no feedback on the functioning of the ABC system, and the managers indicated that there were no mechanisms or encouragement for feedback.

Does AFRL's ABC Model provide relevant information for management decisions?

In answering this question, we must first determine what information the system is currently delivering. The system is not actually reporting any new information, it is simply formatting it differently, putting together a composite picture with costs grouped in a different fashion. Costs are put into the four categories of Product Support, though some TDs indicate that those are not the categories they would have chosen. Other managers question how relevant base operating support and depreciation are to them. One answer was that the TD gains insight into how much money they are actually spending on product support, something that had not been specifically looked at before.

As far as what ABC managers at the TD level want out of the ABC system, standardization was a recurring theme, though from two different perspectives. First, the way product support costs are defined should be standardized, while allowing the TDs flexibility to choose the activities to be used in the system. It should not matter how the activities are defined, as long as specific types of

expenses are consistently classified as either product or product support costs.

Second, standardization across business areas within AFMC, not just AFRL, was a concern. This is because AFRL and the rest of AFMC do not operate in the same way. For example, the directorates do not receive operations and maintenance money the way most AF units do. They rely for the most part on reimbursements, hence the Job Order Cost Accounting System (JOCAS) through which they charge their customers.

Another desire is to "align the system with the way we do business", with the JOCAS system. The ability to identify areas where costs are high, not commensurate with how much actual research is being done, is also identified as a desired outcome. Other respondents were quite forthright in saying that they are still looking at what the system is really providing at this point and are trying to identify how to use the data they are getting. One person was rather confident that they could provide any piece of data a manager could want. Overall, most of the respondents, approximately 80%, declared that there was confusion as to what the ABC system was providing and how to use it.

There was wide disagreement on whether or not the level of detail in the model was enough. Once again, current definitions of activities and infrastructure were cited as limiting the usefulness of the present level of detail. If the definitions were not applicable to the individual TD, then the details would not provide the data the TD management would like to see. For the most part,

financial managers felt that level II (Fig 10, same as Fig 9) provided enough detail to be able to make decisions.

Until recently, AFRL/HQ received only the level I data. Headquarters only wanted a top-level view; how finely divided the TDs made the data was up to them, to suit their purposes. For TD-level management, there is no perceived need for base operating support and depreciation information, since they are unable to influence those costs anyway. Opinion was evenly divided on whether or not detail was sufficient for making decisions.

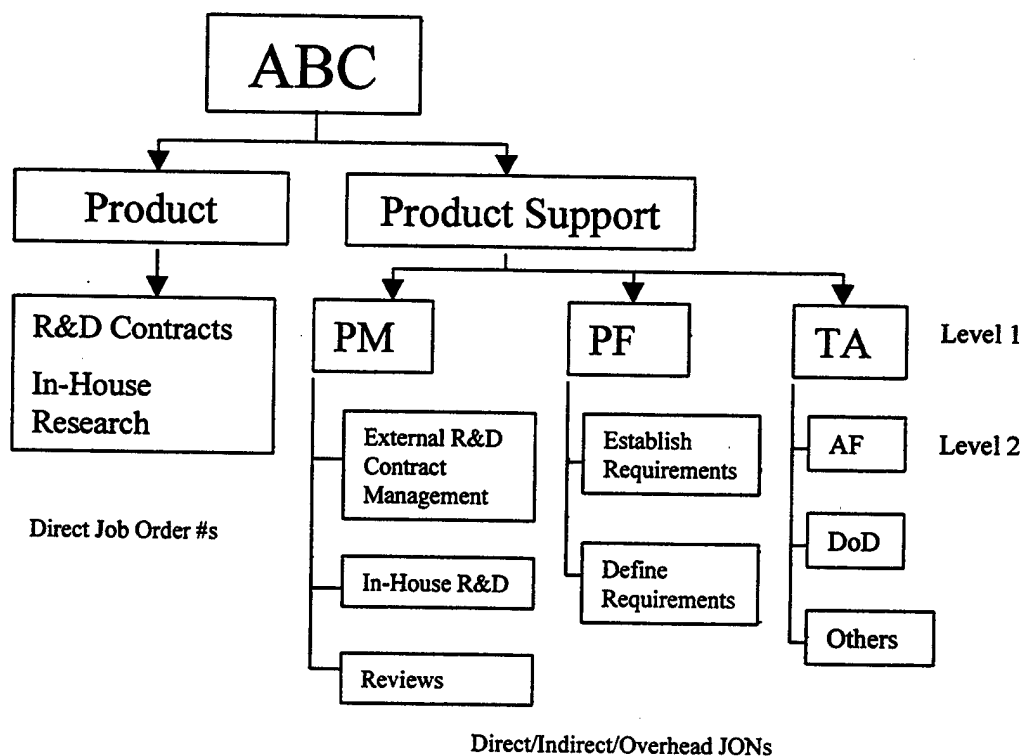


Figure 10: Pictorial Representation of Product and Product Support Breakout
(AFRL Corporate Board, 1998)

There was unanimity as far as how much of total resources the system actually tracks, namely 100%. The system is capable of assigning all of the costs incurred by the labs.

The data being generated by the system is not being used to make any specific decisions. AFRL's primary use is to gain an understanding of where the product support costs actually are, to gain visibility into the relationship of product support to product. This goes back to the observation that even though the system is reporting costs in different areas, nobody is using the data to specify "this is where we're going to make cuts." The TDs are apparently under the impression that AFRL HQ is going to take the information they gain through the system and direct where cuts are going to be made. Meanwhile, AFRL wants the TDs to provide certain top-level information to them, and tailor the rest of the system to the TD's own needs and make their own decisions on where to reduce costs.

There is currently no attempt being made to establish a baseline of minimal cost of operation, to establish how much a given capacity of product support should cost. It follows that the system therefore cannot be used to calculate the cost of excess capacity.

Does the system collect relevant information in a timely manner?

Some TDs collect the ABC data monthly while others do so quarterly. The data is reported to HQ on a quarterly basis. The data is due to AFRL approximately three to four weeks after the end of the quarter. It is even later by

the time reports are ready to be submitted to the top levels of AFRL, limiting the timeliness at those top levels. It can be used for long-term strategic decisions, but not for decisions that would rely on immediate information.

Some TDs take a fair amount of time trying to make the data as accurate as possible by cross-checking the data they receive from the JOCAS. This involves a lot of labor.

The time it takes for the information to go up may be a moot point, as there is widespread agreement that the data is not being used to identify opportunities for efficiencies. Only one instance was reported, and that was a look at where manpower cuts could possibly be made, not an analysis of activities to be eliminated, reduced, or modified. The possible cuts were not identified on the basis of excess capacity, but rather by the relative magnitude of manpower authorizations.

The information that is gathered is not made available to anyone other than those involved in detailed financial management. Line managers are not involved in the process. The information is presented to AFRL in an approved spreadsheet format. Once at AFRL, the data is consolidated and presented to top AFRL management through briefing slides. The information is generally thought to be easy to understand, once it has been explained.

What resources, activities, cost objects and first and second level cost drivers are used and what are the relationships between them?

The resources and activities used are standard across the TDs, with some terminology differences in the resource categories. Also, the TDs have minor variations in consolidating resources. The following is a generic list of resources:

- Outside R&D contracts,
- Civilian Labor,
- Military Labor,
- TDY,
- Training,
- Supplies/Equipment,
- Non-R&D contractor support,
- Facilities,
- Depreciation,
- Base Operating Support.

The activities are listed and defined in Appendix A, with level I and II activities represented in Figure 10. None of the TDs is attempting to assign costs to a final cost object. Due to the nature of the product, research, it was felt that attempting to cost such a nebulous concept would be beyond the scope of an initial implementation effort. Simply defining the quantity of research done, is a difficult exercise.

There are basically two types of first stage drivers, or how resources, specifically labor costs, are assigned to activities. The first one is direct; labor costs can be traced to specific projects by tracking the Job Order Number. This suffices for breaking costs into the categories of product and product support. Once the costs have been determined to be product support, the second method is used. This relies on surveys that indicated that in doing product support, 10% of employees' time was spent doing program formulation, 80% was spent doing program management, and the remaining 10% was spent doing technology application. The labor costs are assigned to the different activities, where they are further broken down into the level two activities, again using percentages. The surveys were done at each individual TD.

Some TDs are able to track nearly all of their labor costs directly, using the JOCAS. They have redone the structure of the JOCAS to reflect the activities used. Operations and support costs are treated as overhead costs and are allocated to the three activity areas by using the actual proportions of labor hours charged to program formulation, program management, and technical application.

Non-labor costs are assigned to product or product support in one basic fashion with minor variations between TDs. Some things, such as scientific equipment, are fairly easy to classify as product costs and are directly traced. The costs that are not traceable go to product support. Once there, they are allocated to the different activities based on the same percentages used for allocating labor among the activities.

How is the cost information being gathered?

Headquarters. The ABC data is reported by each individual TD on an ExcelTM spreadsheet. Each TD's numbers are rolled up and briefed to AFRL senior management where it is evaluated as a composite. Headquarters provides no specific direction on how to assemble cost information.

Directorate. At the TD level, gathering and processing of ABC data is purely an FM function. The TDs have various accounting systems to use for collecting data; JOCAS and the General Accounting and Finance System (GAFS) are the main ones. The JOCAS operates differently at various sites, in part because the JOCAS systems for some TDs were developed for traditional job order cost accounting, while others use theirs for reimbursable accounting. The cost data is extracted from the system based upon the TD's JOCAS code numbers. These costs are then separated into the appropriate ABC category through the procedure outlined under research question 3.5. It was noted by a number of directorate employees that the financial data often took an inordinate amount of time to travel through the system; thus, it was not very timely.

Research Objective 4

What activities or processes are unique to AFRL/DE whereby they would not be applicable to be included in other directorates' ABC models?

The resources used are fairly generic and do not require adjustment. The resources were agreed upon by representatives of all the TDs. There are, however, different funding sources that have different rules for how they are handled. Each TD receives a different proportion of these funds as a part of the total funding. Resource drivers are also comparable across directorates.

Though the activities that each directorate performs are virtually the same, there are differences in how they are accomplished. Each TD has its own accounting system that operates differently; there are certain functions that use different software. For example, one TD has a unique automated document preparation system. One of the directorates is responsible for the contracting function for the whole base, not just themselves. There are also different support contractors, administering different types of contracts. These differences indicate that the first stage cost drivers (resource drivers) should not be the same for different organizations. Their activities consume resources in varying amounts and for different reasons.

Most personnel interviewed agreed that the research process is fairly standard, regardless of directorate. The major difference that does exist is between different research projects that are either in-house efforts or contracted out. Support requirements are different for each type of contract. Most TDs perform both of these types of contracts, but not in the same proportion.

Virtually all personnel expressed concern about comparability of ABC data, particularly in the way it is gathered. Each TD has its own system for gathering

data, in part because the JOCAS systems for some TDs were developed for traditional job order cost accounting, while others use theirs for reimbursable accounting. This concern about comparability is partially due to a perceived difference in activities and accounting structure. The larger concern is that differences in data collection and classification of costs would make some TDs look better than others. When asked about comparability, the AFRL/HQ representative expressly stated that the directorates are not being compared to each other.

When asked about the formulation of the ABC model and if each TD would need a unique structure, there was wide disagreement. Many disagreed with the choices of activities and decried the lack of versatility of the model. Some wanted the model to be designed around their accounting system and reflect the way they operate. Others wanted more emphasis on activities that they could actually influence, and thereby gain more useful data. There was a minority who believed that differences were not significant enough to warrant an entirely different design.

Research Objective 5

Do users believe that there are improvements to be made to the existing model?

Most respondents believed that significant improvements could be made. Most dealt with getting more detailed information out of the system. For

example, being able to either identify processes where it would be possible to reallocate resources or gaining visibility into what actually drives the cost of activities would both be beneficial.

One of the financial managers simply wants a better understanding of what the data being collected actually means, for the system to more closely follow current business practices.

One of the division chiefs in a TD does not know what the indirect charges he is being assessed actually go to. He does not see the connection between his business and the product support activities.

One particularly cogent observation was that the system cannot currently provide an idea of what the optimal relationship of product to product support costs is. At this point, nobody knows if any of the product support costs are truly excess or not. The difficulty of determining this is compounded by fluctuating budgets where the product dollars vary greatly, but personnel cuts cannot be made short term, producing wild variation in the so-called unit cost.

Summary

This chapter compiled our interview data and sorted it by our research questions. The research questions follow our research matrix from Chapter III. Once sorted, we summarized and analyzed each question according to the answers that we received during the interviewing process. This analysis will be used for the development of our conclusions and recommendations in the final chapter.

V. CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents the conclusions and recommendations derived from the research findings. We will do this by building on the analysis presented in Chapter IV. In the previous chapter we provided primary data that answered each research question. That primary data, along with any secondary data we collected, will be the foundation on which we will base our conclusions and recommendations. By addressing all the research objectives we will provide AFRL a document that we hope they will find useful in improving their ABC system. This chapter will conclude with possibilities for future research.

Research Objective 1

Our first research objective was to determine the overall motivation for implementing ABC for AFRL headquarters and at the technical directorate level.

The research questions we posed in order to achieve this objective asked what the motivations were for implementing ABC and if decision-makers perceived a need for the type of information an ABC system could provide. The answers to the motivation were twofold: first, that it was a top-down requirement, and second, that the information the system would provide would help guide cost-cutting decisions, specifically in the product support area. The lower we went in the organizations,

the more the implementation was viewed as being a tasking from above, without real use at lower levels.

Once we have determined that the motivation for implementing ABC is to reduce support costs, it begs the questions: are the objectives suitable for an ABC system, and are those objectives being met by the current system? We will look at this from two perspectives; from that of AFRL Headquarters and from an individual TD point of view.

To reiterate, the Headquarters' objective in implementing ABC was to better understand the costs of supporting research. It was expected to be useful for making some high-level decisions, such as pointing to high-cost and manpower-heavy areas where cuts could be made. It was expected that the TDs would also be able to use the information to make more targeted, specific cuts – not necessarily in manpower, but anywhere they could find savings in support costs.

We examined our data to determine if these objectives were realistic as viewed by our respondents and as compared to information from the literature review. Specifically, we looked at how an ABC system can refine cost data based on product diversity and complexity.

The Headquarters' primary goal of cost visibility is realistic; the concept of identifying support vs. product costs is relatively simple. Gathering this type of data should also be fairly straightforward. One of the obstacles to gathering consistent data is the fluctuating nature of the overall research budget. The ratio of product support to total costs depends heavily not only on how much money a TD

has to spend, but also on what type of revenue source it came from. Revenues such as Congressional add money cannot be spent on product support, and therefore go directly to product. This ignores any additional product support necessary to administer the additional research projects. Any analysis done on the resulting unit cost ratio must take into account changes in these factors. The true picture is also distorted by considering any funds put on contract for contracted research as being purely product. This immediately discounts anything the contractor spends on support, and therefore penalizes any in-house research effort for incurring support costs that would not be apparent in a comparable contract. To then make any decision based on the relative costs of in-house vs. contracted research is faulty because they are not comparable. All of these factors must be taken into account when analyzing any cost data.

Another difficulty arises in this specific implementation of ABC. The first time results were briefed the data from all TDs were on a single slide. This created the impression that they were being compared to see who had the most favorable ratio. The individual TDs are intellectually aware that the data is not being gathered for purposes of comparison, yet the initial impression remains. This has incentivized the system to being biased toward putting every possible expense on the product side. This gives the appearance that the TDs are reducing product support costs through sophistry instead of taking measured steps to reduce costs. This is not meant to imply that cost reduction measures are not taking place, only that they are not using solid ABC data to make those reductions.

The possible distortion in the unit cost ratio is not necessarily a concern for Headquarters since they want a top-level view. In particular, as long as the individual TDs remain consistent in their data gathering, any differences between TDs is unimportant. However, the true costs of supporting research will remain hidden as long as anything possible is charged directly to research.

Prior to the implementation of ABC, product support costs had not been broken out from product costs in this format. Thus, the Headquarters' objective of greater cost visibility is being met, but they do not have cost visibility at a level that will allow them to make informed costs reduction decisions. How much accuracy they need is a matter of judgement. By directing the implementation of ABC and tracking the unit cost ratio, Headquarters has at least focused the TDs' attention on reducing support costs in the attempt to reduce that ratio. Unfortunately, it is difficult to discern between the effects of cost-reduction measures and reclassification of costs as product.

From the TD perspective, there is no universally understood purpose for setting up an ABC system. At this level, the primary reason they are doing ABC is to satisfy a higher headquarters' requirement. They view the imposition of the ABC system as a financial tasking to provide data for higher headquarters to use for their own purposes. Even without buy-in, TD leadership and ABC personnel seem to realize that ABC is intended as a tool to help them better understand the support costs and be able to target areas for reduction.

Though the TDs might not have initiated ABC on their own, the motivation for implementing ABC at the TD level is understood. The purpose of finding ways to reduce product support costs is realistic. Given enough detail and the freedom to design a system around the way individual TDs operate, ABC could provide TD management with pertinent data for making cost reduction decisions. However, the implementation of this particular system has hindered how useful it is to the TDs. The imposition of activities without the step of refining and modifying them to fit specific situations inhibits creative solutions for problems encountered in structuring the system. Definitions of activities could not be modified to take advantage of current cost systems in some cases. This leads managers to view ABC as another fruitless, imposed-from-above exercise that has no bearing on their activities. The financial managers do not feel that they own the system, and this impedes their acceptance of it. Also, the lack of buy-in tempers their enthusiasm to learn exactly what a good ABC system can provide them. Without this understanding ABC is not being implemented in a way that can benefit the organization.

Research Objective 2

Our second research objective was to determine how the information is actually being used at the HQ and TD levels, compared to stated motivations or objectives. We used three research questions. First, we asked if the current ABC system provided qualitatively different information than the previous system. Next,

we wanted to know who receives the data the ABC system provides. Finally, we wanted to see if the ABC data has affected the decisions made regarding cost cutting.

The information was different from that of the old system only in how the information regarding support costs was broken out. The information was flowing upward to higher headquarters, but only through financial managers and a few TD leaders; it was not disseminated to lower levels at all. We also found that ABC data was not being used to aid in any management decisions. The exception was an instance where the user was looking for areas in which to make manpower cuts. However, ABC was not actually used to make any final decision. The TDs have not used it at all. One of the reasons for this is that people are still not quite sure what information is being provided and are uncertain how to exploit it. There are also some weaknesses in the design of the system that make it difficult to extract meaningful data – this will be addressed when we discuss structure.

Research Objective 3

Our third research objective was to appraise AFRL's overall ABC model appropriateness and potential for providing AFRL's needed information. We gathered data on how the ABC model conformed to standard practices and whether or not there was opportunity for feedback. We also looked at the relevance of the information the ABC system provided and if that information was delivered in a timely manner. We examined the structure of the ABC model – to include the

resources, activities and first stage cost drivers, and also how the information is gathered.

There were two aspects to our examination of the model. First, we assessed procedures in the development of AFRL's ABC system, then we looked at the structural elements of the system with respect to accepted practices. What we found was not always in accordance with those practices. Before we critique the current effort, we feel it necessary to state that even a seasoned ABC veteran would have had difficulty in designing a system for AFRL, one where it may not even be practical to identify a final product or cost object for ABC purposes. In other words, defining research as a product poses difficulties. Some of our subjects suggested research reports, others thought hours of bench-testing would be a good measure of product. The original goal of implementing ABC was not to cost research, however. For purposes of determining product support costs, a contract or the project itself could be the cost object, with no intent to quantify the end result of the research.

The first problem we observed was that inadequate resources were dedicated to the task. Specifically, there was not enough training provided to the people who would be responsible for the development effort. There were some knowledgeable members of the different teams, but the majority were subjected to extensive on-the-job training. We do not know this with certainty in the case of the people who chose the activities for the model, but later we will explain why this in itself is indicative of a problem. Different teams at different levels did the work. The TD-

level teams for the most part had no experience in choosing the various elements of the system, or in how to analyze the resources and activities to find the first stage cost drivers. What they used to assign resources to activities varied from survey data on time spent performing activities to using direct charge information; both are accepted methodologies.

A lack of training constrained the teams from doing an in-depth analysis of the activities themselves to determine what attributes of the activities were driving the consumption of resources. We would want to know what aspects of formulating or administering a program cause costs to be incurred. We would also want to know how different types of programs drive different activities. This apparent lack of analysis is perhaps the single most important factor in the failure to capitalize on the potential strengths of an ABC system and will be discussed later in further detail.

The absence of education could have been overcome by hiring consultants to oversee or perform the development work, but again, the resources were not dedicated to the task.

Another factor that hampered the effort was the drive to implement ABC organization-wide, without a pilot project to validate procedures and structure. It would have been invaluable to do this on a small scale, perhaps in one directorate, within one technical area. The top-level approach did not provide enough usable detail and ended up causing many iterations and widespread disagreement in constructing the model.

The push to apply ABC throughout AFRL had other effects. Not only was the level of input from TD-level personnel low, once the system was implemented they were not allowed to make changes. The people who work most closely with ABC do not have a sense of ownership. Even the flexibility to change the data collection methods does not make up for this. Without the sense of ownership, buy-in is also affected. Again, the lack of training about ABC and its benefits results in a lack of enthusiasm for the system.

Day-to-day involvement with the system is limited to the financial management personnel who "feed the template," as one person put it. Any information that may be useful to other sections is not disseminated. Any data collection efforts by the finance people are viewed as impositions since there is no perceived value-added.

Involving a broader spectrum of personnel would also have had benefits in constructing the model. For AFRL's overall purpose of cost visibility of support costs it was not necessary to include research workers and managers. They were not attempting to ascertain the total cost of research itself, simply the costs of supporting it. If determining support costs were the only use of the ABC system, the current ABC structure might not be a problem. However, for the system to be useful to the TDs, it requires more detail. To attain a level of detail usable by a TD, the people doing the work at the TD level must be involved in the selection and analysis of the ABC structural elements. In the case of activities, this was not done. The activities were selected by a committee above even the AFRL/FM office. It is

our opinion that it is nearly impossible for a group so far removed from day-to-day operations of the support elements of a TD to have an accurate picture of all the activities performed.

Even the assumption that the TDs' support functions were homogeneous enough to fit a predetermined template are suspect. Again, the prudent path would have been to start at a small scale – one TD, one technical area, and do an analysis of the support for that technical area. By focusing on such a small sector, all possible activities in AFRL may not have been captured, but the lessons learned in doing so could have been applied elsewhere. By starting on a small scale, it may have been relatively inexpensive to use a consultant. AFRL could have started building a core of experience that could have been gradually widened to include more and more of the financial and line managers. The results might have been used to prove the value of an ABC system in the laboratory environment, thus enhancing buy-in from the rest of the community.

On the other hand, the resource categories appear reasonable with the aforementioned exception of considering all contract dollars as product. The contractor obviously has support costs that they must bear; not every dollar that a contractor receives goes into research. This makes the support of contracted research look cheaper than it actually is, and makes in-house research look expensive in comparison. This could lead to the possibly mistaken decision to cut back on in-house projects while contracting out more research. If it is possible to

gain more insight into contractor support costs, a more reasonable comparison of contracted vs. in-house research costs could be made.

The rest of the resource categories appear sound. The process of selecting the categories is fairly straightforward and the representation of financial managers from all TDs on the team that selected them was beneficial. It was interesting to note that no one had any complaints about the resource categories; there was complete buy-in on that aspect.

The selection of resource drivers, or first-stage cost drivers, was also through accepted methodology for labor costs. An estimated percentage of time spent doing an activity can be used to attribute labor costs to those activities. However, there was no analysis done to determine how the activities consumed non-labor resources resulting in the adoption of labor percentages as an allocation base for these costs. This is antithetical to the concepts of ABC. AFRL has narrowed the number of allocation bases down to one. Even a traditional accounting system recognizes that multiple resource drivers will increase accuracy.

In any case, directly tracing labor costs to a cost object where practical is desired. This is a method for more accurately assigning cost to products.

Assigning costs to cost objects was not the goal in this case. The goal was to segregate the support cost from the actual hands-on cost of doing research, without attributing the support costs to a cost object. (In this regard, the simplest way to determine this might be to take the total budget, and subtract the cost of scientific equipment and the salaries of the scientists (less, of course, the amount of time they

spent doing administrative tasks)). The very essence of an ABC system is the potential of assigning more and more indirect costs to a specific cost object if the indirect costs are incurred in the production of that cost object. The ideal ABC system would allocate all logically attributable costs to a product. The advantage in this case would then rest on being able to identify activities that were non-value added and could be eliminated, or activities that were perhaps necessary, but could be cut back by altering the attributes of the product that were driving the cost. An example of an attribute that drives activities and thereby costs could be the number of parts in an assembly. If the assembly were redesigned to need fewer parts, this would reduce the amount of assembly activity that the part requires. Thus, an analysis of activities at the TDs could possibly uncover characteristics of the support processes that could possibly be altered to require less support activity. That is a weakness in the current effort at AFRL.

We see little evidence of attempting to structure the activities in a way that is conducive to doing any analysis on cost drivers. The exception is the differentiation between customers in the area of technology application, where an analysts could look at the factors that drive costs in servicing an Air Force customer compared to those involved with other DoD agencies, and even non-DoD agencies. An application immediately springs to mind in the area of program management. All programs and contracts are not the same. For example, what are the activities in program and contract management that would make some more expensive to administer than others? Once these are discovered, some directed efforts could be

made to cut costs. For example, a Small Business Innovative Research (SBIR) contract is more expensive to administer than one involving a larger, more established contractor. An analysis would reveal why they are more expensive and might also indicate what could be changed in order to make them less expensive. If that is not possible due to Congressional mandate, then at least managers will be armed with answers when asked why the cost of research is high.

There is also no way under the current structure to discover what capacity of research support the TDs have. According to Mr. Weideman, no one really knows what the optimal proportion of product support costs to total costs is. Until there is an effort to see what drives support costs, one cannot tell what the minimum amount of support is for a project. Thus a determination cannot be made whether or not there is excess capacity that can be cut or held in reserve. Until these types of analyses are undertaken, it is simply an exercise in taking accounting data, rearranging it, and calling it ABC.

Research Objective 4

The fourth objective was to address the conflict between the need for standardization and the desire for flexibility. We did this by asking what processes and activities are unique to AFRL/DE and if present, why they might not fit another TD's ABC model. We found that the resources are fairly straightforward and generic. Some of the major differences are in what types of research are done and the proportions of the different methods for managing research. For example, TDs

conduct differing amounts of in-house research and contracted research, some of which is reimbursable and some of which is not.

One of the concerns we continued to hear about was the comparability of each TDs "unit cost" to the others'. In particular, people were worried that if they had a high ratio of product support to total costs their TD would look bad. The executives of AFRL understand that each TD is in a unique situation, especially with regard to the support costs they have to pay. Therefore they are not as concerned with the TDs' performance in relation to each other as in seeing improvements within a TD. They are also interested in knowing what support costs are for AFRL as a whole. Therefore, if standard definitions of support costs are used, then AFRL can be assured of using a number for support costs that has some meaning. The definition of a support cost does not necessarily have to constrain the construction of activities to use in ABC. Some flexibility should be allowed to the TDs in defining the activities they would want to use.

There was also concern over base operating support and depreciation costs being used in determining support costs for a TD because these costs are not part of a TD's budget. For AFMC to understand the cost of doing research in AFRL it may be necessary for them to include these costs because in most cases they own the base that supports the TDs. However, any decisions AFRL makes needs to be made with the understanding that unless the support goes away from the base or the building can be sold or rented, there is probably no economic basis for including those costs in the decision process.

All told, the processes involved in supporting and performing research appear to be fairly homogeneous and would not require vastly different ABC structures. Since a dedicated ABC data gathering system may be too expensive, the structure of each TDs ABC system should be in accordance with the most practical way to gather meaningful data. If the activities are different, so be it. The detailed ABC data is for the TDs' own use. Since consistency is more important than absolute accuracy, steps can be taken for those TDs that spend a lot of time gathering the data to simplify their procedures.

Summary of Key Findings

Before we continue on to Research Objective 5, Suggested Improvements, we would like to specifically address some key findings from Chapter IV. We will describe what the findings are and then explore their implications.

- No new processes or software were put in place to gather data for the ABC system. Though this can be expensive, there must be a system for accumulating and processing information. ABC is a different process for costing products that requires a different type of information than a typical cost system. It is very uncommon for pre-existing financial systems to be able to provide the information necessary to satisfy ABC requirements.
- In the initial stages of an ABC implementation it is acceptable to have upper-level management determine what activities should be used. It is important to realize that an ABC system evolves from an initial format to one that will work

to suit management's purposes. As part of this evolution, any downward directed structures must be validated for their fit and usefulness. The system must be flexible to adapt to any real-world idiosyncrasies encountered. In this case, once the activities had been determined at a high level, there was no flexibility allowed to the TDs to mold them to their individual situations. This has resulted in an ill-fitting model for some organizations.

- In the current system, for the terms product and product support to have any meaning, their definitions must be standardized. What is a product cost at one TD must be a product cost at all others as well. Only then would the unit cost ratio have any meaning for upper management. For the rest of the model to operate as an ABC system, it would have to remain flexible enough to adapt resource drivers, activities, and other elements to the actual ways activities are performed.
- AFRL's focus on the unit cost ratio creates an incentive for the TDs to attribute costs to the product category whenever remotely justifiable. The original intent was to provide a yardstick for measuring progress in cost reduction efforts. As it turns out, it has become difficult to distinguish real progress in cost reduction from data manipulation. Eliminating the focus on the ratio of product support to total cost will allow the system to be geared to a goal for which ABC is suited. The overall objective for AFRL is to obtain the most research possible on a given budget. Reducing all costs of doing research would help achieve that goal. The artificial distinction, in ABC terms, between product and product

support costs hinders a reasoned analysis of why costs are incurred in performing research.

- Including BOS and depreciation has little meaning at the TD level. For example, any decision by a director to eliminate positions on their staff will probably not lead to a reduction in base-level staffing or support activity; it takes drastic reductions in a base's population before services are cut. Similarly, the decision to vacate a building does not mean the building will cease to depreciate. It is understandable that AFMC leadership would like this type of data since they actually make decisions that can cut base support costs or move a new organization into a facility, but this information should probably be kept away from the ABC system. It would only muddy the picture at the TD level.
- Many of our interview subjects were critical of the length of time it took for the ABC data to be gathered. The information does indeed take a long time to go through the reporting chain. This is not as critical as it may seem. If any decisions were to be made using ABC data, they would not normally be short-term. The process of reengineering activities and cost objects to reduce resource demands is not generally done quickly. A decision to eliminate or modify cost objects is more strategic in nature.
- The model provides such unreliable data that anyone who knows its intricacies is afraid that it will actually be used for decision-making. We have discussed several aspects that introduce distortions into the model, to then base significant

decisions on this data may be counterproductive. The level of confidence in the ABC structure indicates that major overhaul is needed.

Research Objective 5

Our fifth research objective entailed providing suggested improvements to AFRL's ABC system if we found deficiencies. We asked the users what improvements they thought could be made to the existing model and combined those inputs with an analysis of the system based on the literature review.

We indeed found several areas in which we feel there could be improvement. In fact, we believe AFRL's ABC system is in need of general revision. In the following analysis we will provide a systematic approach that gives detailed listings of where we think AFRL could better implement ABC within the directorates.

The current system is providing AFRL/HQ a top-level, albeit distorted, view of what support costs are and should be kept in order to continue providing that until a new system is developed. The distortions notwithstanding, there are other factors that argue for keeping the old ABC system on-line until an improved system can be put in place. First, the work has already been done and it appears the TDs have a good handle on the data-gathering process. Therefore, the cost of simply collecting their current data is not too large. Second, there is a cadre of personnel who have had rudimentary training in the concepts of ABC and are involved with the current system. If the old system is removed immediately, the financial managers will lose

their focus on ABC since a new system will take time to implement. There currently is a network of personnel from the various TDs who are in communication regarding ABC issues; this network should not be allowed to dissolve. We are also concerned that eliminating the current ABC system, only to resurrect a new version later, would alienate the involved workforce, thus jeopardizing it's acceptance.

Rebuilding the ABC system to take advantage of the attributes of ABC could eventually provide data superior to the current systems. Once users are educated on how to use it, the need for the old system will fade and the time currently spent maintaining it will be saved.

In order to do a proper analysis of the cost of activities, it is necessary to understand what causes the activities to be performed. It may be easiest to do this by following the entire chain from resources to cost objects. Simply selecting a cost object or set of cost objects is difficult in this situation; quantifying research presents problems. However, with the focus on support costs, the product being costed does not need to be the final result of research, but rather an interim product. Some possibilities for cost objects are completed research reports, whether positive or negative, or contracts. Distinguishing among different types of contracts would spotlight the factors that drive activities. In-house research compared to contracted research could also be a starting point.

Resources and activities also need to be determined. It may be possible to use most of the categories of resources now used. If BOS and depreciation will not be

used at the TD level for making decisions, it may not be necessary to include them in an ABC model; retaining them might complicate the system too much for little value-added. Choosing activities must involve the people who perform the activities.

At this point the drivers must be developed – how to connect resources to activities and then connect the activities to cost objects. For labor costs, using a survey instrument will determine the relative amount of time spent on activities, but can only point to areas that incur a disproportionate amount of cost. It will not indicate how the activities or the attributes of the cost object can be altered to create savings. To do that, the details of an activity need to be examined to determine why the activities require the amount of labor that they consume. The same holds true for the non-labor resource drivers. They should be based on an analysis of activities to determine which activities consume specific resources and why they consume those resources.

It is likely that AFRL cannot feasibly expend the resources needed to build a dedicated ABC data gathering system. This may mean that the TDs need to continue using existing accounting systems. Using the JON system to assign costs to projects can help when an actual cost object is used, but the cost object chosen must then be readily discernable by JON. In other words, the system must be able to distinguish between cost objects by using JOCAS – the product the JON is dedicated to could also be the basis for selecting cost objects. Indirect JONs would require an analysis of the activities within them to attribute costs to the cost object.

This process should be performed on a small scale, either within one directorate or within one technical area. Even though the scale would be small, the area chosen should be representative of a diverse range of business processes. As many types of research (ie., intramural vs. contract) and contracts and other distinguishing factors should be represented as possible in order to find the differences in the costs involved in supporting them. Doing a pilot study on a small scale would cut down on expenses if consultants were to be used. A small study would also reduce the imposition on employees.

After the system is implemented, the data it provides should be analyzed, particularly to find any results that are surprising or unexpected. If the results are significantly different from the current system then a further examination should be made to see if targeted cost reduction or other decisions can be based on the information. Management may see what an ABC system can really do for them and may be more accepting of the change. If the results are promising and are generalizable to AFRL as a whole, then the implementation should be widened. It may not be prudent to do all of AFRL at once, but rather to implement a pilot program at each TD using the lessons learned from the first implementation.

If ABC were to be implemented across AFRL, then employees would need training on what ABC can do for them. This would promote buy-in at the lower levels.

Action Recommendations

- As detailed under Research Objective 5, keep a limited ABC system in operation until it is replaced
- Develop a new ABC system from the ground up
- Eliminate the distinction between product and product support
- Specify what the product is or develop cost objects
- Provide detailed training to employees involved in the development
- Recruit outside professional help in doing resource, activity, cost object, and cost driver analysis
- Link resources to cost objects through activities by using logical first and second stage cost drivers
- Develop new system on a small scale by doing a pilot study within one division
- Use new software or add new structures to accounting system to provide data
- Critique the results and modify the system as necessary
- Share the results with the other TDs
- Determine if the system can help identify potential cost savings through reengineering activities or cost object attributes and if cost of implementation on a larger scale is cost-effective
- If larger implementation too costly, lessons learned about reengineering processes and activities may translate to other TDs without using ABC

- If larger implementation is feasible, use now-experienced government employees to assist other TDs

Recommendations for Further Research

Our recommendations follow the suggested improvements from the fifth research objective. If AFRL does indeed modify the system or start over, there are opportunities for research into cost objects and how to define them when they are as nebulous as experimental research. A further, more detailed analysis could be done to specifically aid AFRL in developing a new system. If kept to a limited area within a TD, the research could be small enough in scope to be manageable. A full-scale implementation would require a great deal of time and manpower. A smaller scale would allow a more thorough job in determining the resources, activities, cost objects and first and second stage cost drivers. A limited project would allow the researchers to use the actual accounting data and would produce quantifiable results. These results would then aid in determining if the effort should be expended to build ABC systems elsewhere in AFRL.

Appendix A: Definitions of AFRL TD Activities

Program Formulation - the activities generally associated with defining the overall R&D program.

Project Management - the activities generally associated with buying and managing R&D.

Technology Application - the activities generally associated with connecting the customer with the right technology.

Operations Support - All other activities that support day-to-day business.

(Operations support gets folded into the other three activities and is allocated to the other support areas)

Level I: (1.1) Program Formulation.

- **Assess Needs/State-of-the-art:** Activities that help the customer define their true requirements such as support to the Modernization Planning Process
- **Strategize Investment:** Activities to help determine how the R&D budget will be distributed across the overall R&D program
- **Establish and defend budget:** Activities to help actually build the budget (POM, APOM, BES, etc), and defend the budget
- **Interface with Customer/Suppliers:** Activities and discussion with suppliers to help determine the investment priorities, etc that will eventually help determine the overall structure of the R&D program

Level II: (1.1.1) Establish Requirements.

- Establish requirements includes all activities associated with identifying, reviewing, and prioritizing customer & stakeholder requirements.

Examples of activities captured in the level II activity are, strategic planning, Defense Technical Area Plan (DTAP) process, TMP/Technical Planning Integrated Product Team (TPIPT) process, and other activities used in prioritizing customer requirements.

Level II: (1.1.2) Defining Programs.

- Defining programs includes all activities associated with planning and programming the FYDP Science and Technology programs. An example of activities captured in this level II activity is the Program Objective Memorandum (POM) and Budget Estimate Submission (BES) process.

Level I: (1.2) Project Management.

- Define Project (make or buy): Activities directed toward determining whether a specific project can be conducted in-house or should be contracted out
- Procure Research and Development: Activities associated with the process of preparing for and awarding a contract to conduct R&D
- Manage Project: Activities associated with ensuring contractors and other suppliers develop the right thing at the right time for the right amount of money
- Interface with customer: Activities conducted to ensure the customer is kept up to speed with the progress of the project and that the customer's needs are addressed throughout the project.

Level II: (1.2.1) External R&D Contract Management.

- External R&D Contract Management includes all activities associated with the day-to-day management of external R&D contracts. It includes on-site visits to contractors, contractor interface, Program Management Reviews (PMR), preparation of Request for Proposals (RFP) packages, and program element Management.

Level II: (1.2.2) In-house R&D management.

- In-house R&D management includes management oversight of ongoing in-house efforts

Level II: (1.2.3) Reviews.

- Reviews include all activities associated with reviewing and approving directorate S&T programs. Examples of activities captured in this level II activity are Science Advisory Board (SAB) reviews, buy plan reviews, internal reviews, and external reviews (AFRL, SAF, AF).

Level I: (1.3) Technology Application.

- Transfer Technology: Activities associated with ensuring technology developed in the laboratory is made available to the private sector and academia
- Technology Transition: Activities associated with ensuring technology developed in the laboratory is make available to our Air Force users
- Consulting: Dealing directly with AF customers, acting in a consulting

capacity to determine their specific needs, determining whether technology to satisfy their needs exists or is in development, or helping them establish and explain their requirements.

Level II: (1.3.1) Air Force (AF).

- Technology Application costs associated with transitioning technologies to Air Force customers.

Level II: (1.3.2) Department of Defense.

- Technology Application costs associated with transitioning technologies to the Navy, Army, and other DoD customers.

Level II: (1.3.3) Other customers.

- Technology Application costs associated with transitioning technologies to non-DoD customers.

Level I: (1.4) Operations Support.

- Human Resources (development and management): Performance plans and reports and other administrative activities associated with keeping and developing the human element of the lab, training
- Facilities/Equipment management: Maintenance, management, procurement of equipment necessary for day to day operations of the work force (not specifically associated with a project) e.g. staff vehicles, office buildings, etc.
- Manage Information systems/equipment: Time spent upgrading, maintaining, etc., office systems for day to day operations. Also all business process improvement activities

- Other support, e.g. travel, protocol, security, safety, environmental, etc.

Level II: (1.4.1) Management & Supervision.

- Management and Supervision includes management and supervision costs that can not be attributed to Program formulation, Program management, Technical Application, and supervisor training.

Level II: (1.4.2) Administrative Support.

- Administrative Support includes activities like Human Resource Management, Security, Public Affairs, Protocol, Administrative training, and other military/civilian duties (military readiness, non-AFRL duties).

Level II: (1.4.3) Technical Support.

- Technical Support includes activities like Facilities/Equipment Management, Safety, Management Information Systems, technical training and Supply.

Appendix B: ABC Questionnaire

Interviewers: Capt Martin Memminger
Lt Jayson Wrona

Appropriateness (1-37)

1. How supportive is the TD's senior management of the ABC system? Senior management at the headquarters level?
2. Do the employees in general support the implementation of ABC? Do employees believe ABC will be able to identify areas where there is excessive support functions spending or areas for "smart" cost reductions?

("smart", refers to cutting costs that will allow for a reduction of funding without impacting the quality of work being performed)
3. As rough percentages, what percentage of management and support personnel embrace the implementation of an ABC system?
4. To your knowledge, did the appropriate people contribute to the formulation of your ABC system and to what extent? Did you contribute?
5. Were you trained about the potential benefits of ABC before it was implemented and if so do you feel the training was adequate to allow you to understand and support the ABC implementation?
6. If training was insufficient, how much more training would be required and who and what kind of training should it be?
7. What was the original purpose for the implementation of ABC in your directorate?

- 7a. Is that original purpose realistic?
- 7b. Is ABC successful in achieving its goal or fulfilling its original purpose?
8. Were you given any specific guidance for implementing ABC within your specific directorate?
9. What information do you receive from your ABC system?
10. What information do you want to get from your ABC system?
11. Are there any ambiguities concerning what ABC actually provides and how to use it?
12. Who are the primary personnel that support and update the current ABC system? Are they cross-functional or single-functional?
13. What level of control for the ABC system is there at the Directorate level?
(Branch, division or non-existent)
14. Have you received any training on ABC after its implementation? If so, do you feel the training was adequate to allow you to support and use the day-to-day running of your ABC system?

15. Is there a linkage between ABC to performance evaluation and compensation?

16. To what level of detail is your ABC system recording cost?

(How many and what level of expenses are you able to directly see who is responsible for actually occurring that expense and is ABC capturing that expense at that level)

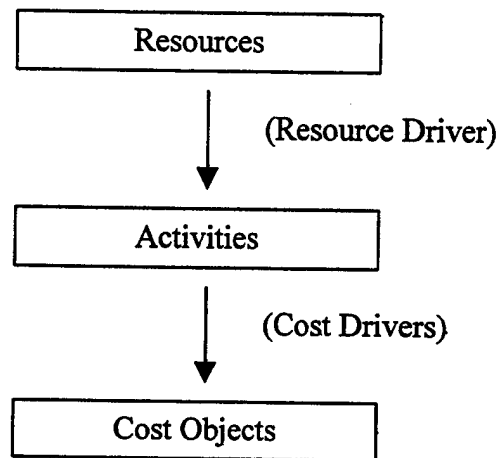
17. What level of cost detail should be required to achieve your initial ABC objectives?

(Level refers to how precise cost information can be attributed to a specific cost object, for example, do all travel cost use the same fund cite or are they broken out by projects, and are they reported as so)

18. Is your ABC system providing output at the necessary level of detail that will allow you to make management decision for achieving the ABC's initial objectives?

19. What percentage of total funding does ABC track from resources to cost objects?

A simple ABC model is composed of 5 main parts: resources, resource drivers, activities, cost drivers, and cost objects. Costs are associated with a number of different resource categories. Resource drivers are then used to match various resources to various activities that are peculiar to the organization. Finally, cost drivers are used to flows costs from the activities a multiple number of cost objects. The final result allows the activities an organization performs to drive the cost of and product or service.



20. Describe how the different drivers are used in your ABC model and how your organization's flows resources to cost objects?

21. How many cost and resource drivers are you aware of? Do you believe there are not some that should be use but are not and what are they?

22. What support costs are directly traced to cost objects?

23. Are there additional overhead costs that would be cost-effective to directly trace to cost objects?

(That is, are there either substantial costs being incurred that are not directly traced to costs objects or are there cost that could easily and inexpensively be directly traced but at this time are not)

24. How are the remaining overhead costs that are not directly being traced to cost objects being indirectly allocated?

(How are pools "groups of like costs" of cost being formed and what kind of criteria are being use to form these pools and determine what percentage goes to the cost objects)

25. What level of detail is required of your ABC model to make management decisions for support functions?

26. Is ABC information being reported at a level of detail that allows for management decisions to be made? Explain.

27. How is the information being provided by your ABC system being used?

28. How is the information being provided by your ABC system useful for pinpointing unnecessary support costs and reducing them while maintaining current product levels?

29. Can the ABC system identify nonvalue-added support cost within cost objects?

30. Is the information provided by ABC in a timely manner that allows for the making of current and useful cost reduction decisions?

31. How often is ABC information being used to identify opportunities for efficiencies?

32. When ABC is used to identify opportunities for efficiencies how does it take advantage of those opportunities?
33. How is ABC information disseminated throughout the workplace?
34. In what format is ABC information reported?
35. How easy is the formatted ABC information to understand?
36. How easy is it to trace the ABC information from high cost support areas through activities to cost objects?
37. Who is privy to key ABC information for making management decisions and how timely is that information?

Mechanics (38-44)

38. What resource categories are used
38a. How were they selected?
39. What activities are used in the system?
39a. How were they selected?
40. What first level cost drivers are used?
40a. How were they selected?

41. What second level cost drivers are used?

41a. How were they selected?

42. In your words, describe how your TD traces costs from resources to cost objects?

43. Do the individual components of an ABC system, as listed above, flow together or are they view as independent pieces within the whole system?

44. Who is responsible for collection and assembly of the ABC data?

Standardization (45-49)

For the next 5 questions, think of how and what kind of information your ABC system is using that is unique to the kind of research you directorate performs in contrast or other kind of directorate research.

45. Does your TD use resources that are unique to your directorate? Explain.

46. Does your TD utilize resource drivers that are unique to your directorate? Explain.

47. Does your TD perform any activities in a substantially different manner than the other TDs? Explain.

48. Does your TD utilize cost drivers that are unique to your directorate? Explain.
49. Does your TD conduct research that uses resources and performs activities in a substantially different manner than other TDs? Explain.
50. As you submit your ABC financial data to higher headquarters what are your concerns about its comparability to other TDs?
51. Are there any unique aspects (peculiar functions) to your TD that would cause your ABC model to be formatted differently from another TD and if so what are they?

Feedback plus Decision Making (50-57)

52. Before ABC was implemented, did decision-makers at the TD level feel that they needed an additional tool to help them make budgetary and managerial decision and did they think that ABC had the potential to help?
53. What kinds of cost reduction decisions have been made since the implementation of ABC and do you believe those were better as a result of ABC? How?
54. Do decision-makers understand how ABC provides different information than traditional cost allocation and if so how do they take advantage of those differences?
55. Have you seen any data on or difference in the type of decisions being made since the implementation of ABC?

56. What mechanisms are in place for feedback from the TDs to AFRL concerning the functioning of AFRL's ABC template?

57. Is there a mechanism in place that allows or even encourages individual employees to provide suggested changes to the ABC model that will allow it to provide better decision making information?

58. How is ABC being used to make informed management decisions? For example, how is ABC being used to make management decisions concerning the amount of funds being spent in product support and what effects those decisions are having on TD's product group?

Also, has management identified products that are costing an exorbitant amount of money due to the activities they incur?

Possible improvement (58)

59. In your opinion, what additional information should the current ABC model provide to enable you to make better cost reduction decisions?

60. Are you using your ABC system to calculate the cost of excess capacity in your activities/processes?

61. Are cost driver rates computed using the historical cost of resources consumed, the budgeted cost of resources, or the cost of the minimum resources required to perform the activities?

Appendix C: Research Traceability Matrix

Research Objective	Research Questions	Investigative Questions	Corresponding Interview questions
1. Determine the overall motivation for implementing ABC for AFRL headquarters and the TDs.	1.1 What was AFRL's <u>motivation</u> in implementing an ABC model?	1.1.1 What was AFRL's motivation in implementing an ABC model?	10
	1.2 What was the <u>motivation</u> for various TDs in implementing an ABC model?	1.2.1 What was the directorate's motivation in implementing an ABC model?	7, 7a, 7b, 10
	1.3 Do decision-makers <u>perceive a need</u> for the information provided by an ABC system?	<i>perceive a need</i>	
		1.3.1 Were decision-makers concerned with possible deficiencies in quality of management decisions before ABC was implemented?	52
		1.3.2 Do decision-makers understand how ABC provides different information than traditional cost allocation systems?	15, 54
2. Determine how the information is actually being used at the directorate and HQ levels, compared to stated motivations or objectives.	2.1 Is the current ABC system providing <u>qualitatively different information</u> than that of the previous accounting system?	<i>Qualitatively different information</i>	
		2.1.1 Is there data on the differences in costs reported before and after the implementation of ABC?	53, 55
		2.1.2 If so, what are they?	55
	2.2 <u>Who receives</u> the information generated by the system?	<i>Who receives</i>	
		2.2.1 Is the information provided to all managers who are able to make cost-reduction decisions?	27, 37, 54, 55
		2.2.2 Is the information disseminated to all employees with a stake in the process?	33
	2.3 Are there any <u>differences in the decisions made</u> as opposed to the decision that would be made were the legacy system still in place?	<i>Differences in decisions made</i>	
		2.3.1 Does management feel that they have made different decisions since the implementation of ABC?	1, 3, 58

Research Objective	Research Questions	Investigative Questions	Corresponding Interview questions
		2.3.2 How is ABC information being used to make management decisions?	53, 54, 55, 58
		2.3.3 Could these decisions have been arrived at using traditional cost accounting methods?	9, 28, 55
3. Appraise AFRL's overall ABC model appropriateness.	3.1 Does AFRL/DE's ABC Model conform to standard practices with respect to the <u>implementation</u> and <u>operation</u> of their system?	<i>Implementation</i>	
		3.1.1 Do both top management and their employees support the implementation of ABC?	1, 2, 3
		3.1.2 Were employees trained on the purpose, functions, and support of an ABC system and if so how much training did they receive?	5, 6
		3.1.3 What was the original purpose for implementing ABC?	7, 7a, 7b
		3.1.4 What specific guidance was given for implementing ABC within the directorate's environment?	4, 8
		3.1.5 Is there a consensus about ABC objectives among its users?	2, 4, 7b
		<i>Operation</i>	
		3.1.6 Who has control over the ABC system structure?	13
		3.1.7 What types of recurring training are being conducted and are they satisfied with it?	14
	3.2 Is there opportunity for <u>feedback</u> ?	<i>Feedback</i>	
		3.2.1 Is there a mechanism in place for feedback from the TDs to AFRL on the functioning of AFRL's template ABC model?	56
		3.2.3 Is there a mechanism in place that allows or even encourages individual employees to provide suggested changes to the ABC model that will allow it to provide better decision making information?	57
		3.2.4 Is there a linkage to performance evaluation and compensation?	15
	3.3 Does AFRL's ABC Model provide <u>relevant information</u> for management decisions?	<i>relevant information</i>	
		3.3.1 What cost information is the current ABC system providing?	9, 11
		3.3.2 To what level of detail is the ABC system reporting costs?	16

Research Objective	Research Questions	Investigative Questions	Corresponding Interview questions
		3.3.3 How complex is the system to track direct and indirect costs for resources to cost objects?	20, 21, 22, 23, 24, 36
		3.3.4 How are the direct costs collected and traced and at what level is it inefficient to collect those direct costs? Likewise how are the indirect costs collected and allocated?	22, 23, 24
		3.3.5 What level of detail is required to make cost reduction decisions?	10, 18, 25
		3.3.6 Are the costs reported to a level of detail necessary to make intelligent decisions?	10, 17, 26
		<i>cost reduction decisions</i>	
		3.3.7 Is the available information useful to decrease costs without affecting product?	19, 10, 27, 28
		3.3.8 Can the ABC system identify expenditures that are above the level needed to accomplish the objective?	28, 29
		3.3.9 Can the ABC system identify nonvalue-added cost within cost objects?	27, 29
	3.4 Does the system collect relevant information in a <u>timely manner</u> ?	<i>timely manner</i>	
		3.4.1 Is the information provided by ABC current and useful for cost reduction and management decisions decisions?	30 37
		3.4.2 How often is ABC information used to identify opportunities for efficiencies?	31,33
		3.4.3 Is the ABC information disseminated through the workplace?	2, 23
		3.4.4 Is the information reported in a format that is understandable and easy to use?	34, 35, 36
	3.5 What <u>resources, activities, cost objects, and first and second level cost drivers</u> are used and what are the relationships between them?	<i>Resources</i>	
		3.5.1 What resource categories are used and how were they selected?	38, 38a
		<i>Activities</i>	
		3.5.2 What are the activities used in the system and how were they selected?	39, 39a
		<i>cost objects</i>	

Research Objective	Research Questions	Investigative Questions	Corresponding Interview questions
		3.5.3 What are the cost objects defined in the system and why were they selected?	20
		<i>first level drivers</i>	
		3.5.4 What first level drivers are used and how were they selected?	40, 40a
		<i>second level drivers</i>	
		3.5.5 If used, what second level drivers are used and how were they selected?	41, 41a
		<i>Relationships</i>	
		3.5.6 Describe the overall process the TD uses to allocate and/or assign cost to cost objects?	11, 20, 22, 23, 24, 42, 43
		3.5.7 How great a percentage of costs does the system account for?	19
	3.6 How is the cost information being gathered?	<i>How gathered</i>	
		3.6.1 Who is responsible for collecting data?	44
		3.6.2 Who is responsible for maintaining the data collection system?	12
		3.6.3 What tools are employed to report data?	34
4. Understand and evaluate AFRL/DE's unique inputs (probability of standardization) that are being injected into the current AFRL model.	4.1 What <u>activities or processes are unique</u> to AFRL/DE whereby they would not be applicable to be included in other directorates' ABC models?	<i>unique processes or activities (as opposed to the other TDs)</i>	
		4.1.1 Are there any resources which are used in a substantially different manor among the various TDs or a need for unique resource categories among the TDs?	45, 50
		4.1.2 Are there needs for TD unique resource drivers within the various directorates?	46, 50
		4.1.3 Are there any unique activities or a need for unique activity categories among the various TDs?	47, 50
		4.1.4 Do the TDs have a need to utilize cost drivers that are unique their own directorates?	48, 50

Research Objective	Research Questions	Investigative Questions	Corresponding Interview questions
		4.1.5 Do TDs conduct research that uses resources and performs activities in a substantially different manner than other TDs?	49, 50
		4.1.6 As you submit your ABC financial data to higher headquarters what are your concerns about its comparability to other TDs?	50
		4.1.7 Are there any functions that are peculiar to a TD, and if so, what are they?	51, 50
5. If the AFRL ABC template can be improved for AFRL/DE, provide guidelines on how to formulate adaptations for DE and other individual TDs.	5.1 Do users believe that there are <u>improvements</u> to be made to the existing model?	<i>Improvements</i>	
		5.1.1 How can the current ABC model be amended to provide the necessary information for better cost reduction decisions or management practices?	7a, 7b, 59
	5.2 Further analysis in Chapter 5 through the data provided by the questions already posed.		

Appendix D: Glossary

Activities: processes or procedures that meet a particular work need of the organization. A unit of work that takes place within the organization and consumes resources. Activities can be classified into five basic types: organization and facility support activities, process-support activities, process activities, customer or market-related activities, and product or product line-related activities.

Activity-Based Costing (ABC): a cost-accounting concept based on the premise that the products and services provided by an organization require that organization to perform activities and that those activities require the organization to incur costs. In ABC, any cost that cannot be assigned directly to a product or service is traced to the activities that make that cost necessary. The cumulative cost of each activity is then traced to those other activities, products, or services that make that activity necessary.

Activity costs: all conversion costs that are not material costs. These costs are assigned to specific activities based on each activity's cost drivers.

Cost assignment view: the view of ABC where costs are assigned to activities and the activity costs are assigned to cost objects.

Cost driver: a measurable factor that is used to assign costs to activities and from activities to other activities, products, or services. Cost drivers are used to reflect the consumption of costs by activities and the consumption of activities by other activities, products, or services.

Cost objective (or cost object): an end item for which the accumulation of costs is desired. There are two basic categories of cost objectives: final cost objectives and interim cost objectives. A cost object is usually a product. However, other cost objects include a job, a product line, or a divisional office.

Customer or market-related activity: an activity that can be identified as supporting a specific customer, group of customers, or market. **Elements of cost:** individual categories of cost that must be distributed among the products, services, and activities of the organization. Cost elements can be classified into two types: material costs and activity costs.

Material costs: all non-payroll costs that are obviously related and specifically and conveniently traceable to a specific product or service. This category of costs not only includes traditional direct materials and direct outside services, but also those indirect materials, perishable tools, or other costs that vary with the amount of throughput, not the amount of time needed to process the throughput.

Multiple-stage approach: an approach to ABC that attempts to mirror the actual flow of costs through an organization. Contrasts with the "two-stage" approach, which moves cost from incurrence to cost objects in just two stages. **Organization and facility-support activity:** an activity involved in the overall management and administration of the organization or in providing a facility in which other activities can take place.

Performance measures: indicators of the work performed and the results achieved in an activity. They can be financial or non-financial and indicate how well the activity meets the needs of its internal and external customers.

Process activity: activities that are part of the chain of events that must take place to produce the organization's products or provide its services. These activities can be batch related (taking place only once each time the chain of events is set in motion), or unit related (taking place for each unit of product or service).

Process-support activity: an activity that provides support to other activities, but does not directly relate to the organization's products or services.

Process view: the view of ABC that provides operational information about activities.

Product or product line-related activity: an activity that can be identified as supporting a specific product, service, or group of products/services.

Throughput: the rate of production of a defined process over a stated period of time. Rates may be expressed in terms of units of products, batches produced, dollar turnover, or other meaningful measures.

Two-stage approach: an approach to ABC that distributes (or decomposes) costs in sub-accounts of the general ledger to activities using "first-stage" cost drivers, and then distributes the accumulated costs in the activities.

Bibliography

- AFRL Corporate Board, Air Force Materiel Command. Corporate Strategy to the year 2010; Outline for the Corporate Strategy Development Facilitation Process. n. pag. Wright-Patterson AFB OH July 1998.
- AFRL/DE Public Affairs, Diagrams and program descriptions, n. pag. <http://www.de.afrl.af.mil/pa/Factsheets/de.html>. May 1999.
- Beaujon, George J. and Vinod R. Singhal, "Understanding the Activity Costs in an Activity-Based Cost System," Journal of Cost Management: 51-72 (Spring 1990).
- Chaffman, Beth M., and John Talbott, "Activity-Based Costing in a Service Organization," CMA Magazine: 15-18 (December/January 1991).
- Cooper, Donald R. and William C. Emory, Business Research Methods, Irwin/McGraw- Hill, 5th ed., 1995.
- Cooper, Robin, and Robert S. Kaplan, "Measure Costs Right: Make the Right Decisions," Harvard Business Review: 96-103 (September-October 1988).
- . "Profit Priorities from Activity-Based Costing," Harvard Business Review: 130-135 (May-June 1991).
- Cooper, Robin, "Implementing an Activity-Based Cost System," Cost Management: 33-41 (Spring 1990).
- . "The Rise of Activity-Based Costing--Part One: What Is an Activity-Based Cost System?" Journal of Cost Management: 45-54 (Summer 1988a).
- . "The Rise of Activity-Based Costing--Part Two: When Do I Need an Activity-Based Cost System?" Journal of Cost Management: 41-48 (Fall 1988b).
- . "The Rise of Activity-Based Costing--Part Three: How Many Cost Drivers Do You Need, and How Do You Select Them?" Journal of Cost Management: 34-46 (Winter 1989a).
- . "The Rise of Activity-Based Costing--Part Four: What Do Activity-Based Cost Systems look like?" Journal of Cost Management: 38-49 (Spring 1989b).

- Ellis-Newman, Jennifer, and Peter Robinson, "The Cost of Library Services: Activity-Based Costing in an Australian Academic Library," Journal of Academic Librarianship: 373-380 (Sept 98).
- Estrin, T.L., Jeffrey Kantor, and David Albers, "Is ABC Suitable For Your Company?" Management Accounting: 40-45 (April 1994).
- Harr, D., "Activity-Based Costing: New Insights for Cost Management," Armed Forces Comptroller: 23-28 (Spring 1991).
- Horngren, Charles T., George Foster, and Srikant M.Datar, Cost Accounting, Ninth Edition. Upper Saddle River: Prentice Hall, 1997.
- , Institute of Management Accountants information service. Practices and Techniques: Implementing Activity-Based Costing, Institute of Management Accountants Statement on Management Accounting Statement No. 4T n. pag. www.rutgers.edu/Accounting/raw/ima/imabc.html. Sept 30 1993.
- Howard, Patrick, "Architecture for an Activity-Based Costing System," Journal of Cost Management: 14-21 (Winter 1995).
- Jehn, Christopher, Assistant Director of the Congressional Budget Office, Address to 32nd Annual DoD Cost Analysis Symposium. Williamsburg, VA 03 February 1999.
- LaLonde, B., and T. L. Pohlen, "Truckers Need to Know About Activity-Based Costing," Transport Topics: 12-16 (October 4, 1993).
- LaLonde, B., K. Tan, M. Standing, "Forget Supply Chains, Think of Value Flows," Transportation: 24-31 (Summer 1994, No. 3).
- Miles, Matthew B., and A. Michael Huberman, Qualitative Data Analysis. Thousand Oaks: Sage Publications, Inc., 1994.
- Miller, John A., Implementing Activity-Based Management in Daily Operations New York: John Wiley & Sons, Inc., 1996.
- Neice, James A. and Vernon L. Scribner, The Implementation of an Enhanced Activity-Based Costing Model at the Defense Supply Center Columbus. MS thesis, AFIT/GIM/LAL/96S-1. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1996 (AD-A1103970).

- Ness, Joseph A., and Thomas G. Cucuzza, "Tapping the Full Potential of ABC," Harvard Business Review: 130-138 (July-August 1995).
- Pitel, Monica, Program Control. "ABC For Dummies", Compendium of briefing charts, memoranda and ABC-specific instructions. n. pag. Air Force Research Laboratories, Directed Energy Directorate, Kirtland AFB NM, 1998.
- Roberts, Michael W., and Katherine J. Silvester, "Why ABC Failed and How It May Yet Succeed," Journal of Cost Management: 23-35 (Winter 1996).
- Runkel, R., Financial Manager. "Science & Technology Business Area" Briefing charts for AFRL leadership conference. n. pag. Air Force Research Laboratories, Wright-Patterson AFB OH, 1998.
- Secretary of the Air Force Staff, Financial Management (SAF/FM) What is Activity-Based Costing/Activity-Based Management? n. pag. <http://www.saffm.hq.af.mil>. 1998.
- Shields, Michael D. and Michael A. McEwen, "Implementing Activity-Based Costing Systems Successfully," Journal of Cost Management: 15-22 (Winter 1996).
- Siau, Carlos, and Dirk Van Lindt, "Cost Driver Analysis in the Airline Industry," Journal of Cost Management: 37-47 (July-August 1997).
- Turney, Peter B.B., "What is the Scope of Activity-Based Costing?," Journal of Cost Management: 40-42 (Winter 1990).
- Weber, R.P. Basic Content Analysis, 2nd ed. Newbury Park: Sage Publications Inc., 1990.
- Weideman, Tom, Financial Manager, Air Force Research Laboratories Headquarters, Wright-Patterson AFB OH. Personal Interviews. Starting 23 October 1998, ending 30 June 1999.
- Woods, M., "How We Changed Our Accounting," Management Accounting.,: 42-45 (February 1989).

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12a. DISTRIBUTION AVAILABILITY STATEMENT Unlimited				12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 words) <p>The purpose of this study was to examine the initial implementation of an Activity-Based Costing (ABC) system within the United States Air Force's Research Laboratories (AFRL). We were attempting to ascertain what the initial purposes for implementing ABC within AFRL were, then determine whether or not those goals were being attained. We also attempted to evaluate the current system's appropriateness for achieving those initial purposes. Finally, we provide suggested changes to the model and areas for future research.</p> <p>We noted problems with AFRL's current ABC system. We were able to condense the problem into two main categories. First, when the system was initially designed, it was hampered by a rigid structure that was predetermined and there was also insufficient training for the personnel in charge of development. The second category is concerned with the implementation of their current system. There were many steps that could have been taken to ensure a successful ABC system. We believe ABC is a potentially beneficial tool that can be used by AFRL if it is developed and implemented in a different manner. ABC, as it is currently being used, is not a beneficial tool at lower levels within AFRL. In order to attain the full benefits of an ABC system, it must be beneficial to those lower levels where cost savings could be found.</p>				
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